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OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Research in the Electrical Industry.

IN his Presidential Address to the I.M.E.A. last week (an abstract of which was given in our issue of June 7th) Mr. Nichols Moore stated that "electrical research was never so important as it is to-day." Unfortunately, the truth of what might appear almost a platitude is still quite inadequately recognised, when the practical test of financial support is applied, by most undertakings in the electricity supply industry. To this industry the ultimate benefits of research must accrue and by each of its members a due share of its cost should be borne. Continuous study and experiment must be carried out, if the conditions due to growth of load and the technical developments thereby necessitated are to be met in the most economical way. It will, we think, be conceded that the necessary research cannot be carried out so efficiently by individual interests as it can be by those interests acting in collaboration through the medium of a specialised body, such as the British Electrical and Allied Industries Research Association, usually referred to more shortly as "E.R.A."

Apart from the indirect advantages to the electricity supply section of a healthy state of affairs in the electrical industry as a whole, the more obvious ways in which it would be benefited through a proper provision for co-operative research are: (1) reduction in development charges, as reflected in the capital cost of apparatus; (2) greater reliability of apparatus throughout a probably longer life; (3) reduction in operation losses, and (4) reduction in maintenance costs. Investigations into the behaviour of switchgear under fault conditions may be mentioned as an example of the kind of research that is of direct importance to the supply industry.

Failure to interrupt short-circuit currents properly may be so disastrous in its consequences that heavy expenditure is justified in guarding against it. In two of the addresses delivered at the I.M.E.A. Convention reference was made to the cost of high-duty switchgear (in one case estimated at upwards of £20,000) to be incurred by an undertaking when connected to the grid.

The appeal of Mr. Nichols Moore for a more liberal support of E.R.A. was under-scored by the Chairman of the Electricity Commissioners at the I.M.E.A. annual dinner last Thursday week. The income of E.R.A. must be increased by at least 50 per cent. if it is to function

effectively, and the fact that Sir John Snell travelled to Torquay at risk to the early recovery of his health for the purpose of placing the facts before a representative gathering is an indication of how seriously the position is regarded by one able to speak with full authority.

Finance is the crux of the situation, since technical skill is, beyond question, available to use any funds provided to the best advantage. It was therefore appropriate that Sir John's speech should have been addressed to an assembly, a large proportion of which was composed of men in a position of responsibility for sanctioning payments of this kind. Members of electricity committees have, as representatives of the ratepayers, the duty of checking waste of money. They have, as it is, to pass for payment subscriptions to several of the "allied associations" (as Mr. Nichols Moore called them) whose practical value they may imperfectly realise. In addition to this negative duty they have, we submit, the more positive duty of spending money on those objects which will make a return that is none the less remunerative because its effect is not immediately discernible in the trading account. The ability to do this is surely the test of the business man, but he must first know the essential facts.

The claims of the Electrical Research Association to financial support from the electricity supply industry have been pressed more than once in these columns—notably in our issue of February 17th, 1928, p. 283, when we advocated that much wider publicity should be given the Association's aims and achievements. It is very much to be hoped that the well directed publicity at the I.M.E.A. Convention will meet with the response that the appeal merits.

The Quest of Markets.

Now that the new Government and the electorate have had time to make a first estimate of what the new situation may involve, and that Cabinet Ministers have been examining their relation to their particular duties, we may perhaps be permitted to emphasise suggestions that we stressed a few weeks or months ago on unemployment as a national problem and one largely affected by world trade and Empire development. Concerning unemployment, it might be excellent if those whose departmental duty it is to produce safe schemes for dealing with the evil, assisted by some authoritative student of affairs with an impartial mind, were to collate all the promises and declared intentions so moderately passed over the broadcast, or delivered earlier in speeches, regarding possible remedies, so that some Cabinet committee could form a considered judgment regarding what could and should be done with confidence of support. Such a non-party inquiry was advocated by us in our issue of November 23rd, 1928 (p. 877). When writing of unemployment, we deprecated the subject being dealt with by men with political axes to grind, and advocated instead of men representing every shade of opinion sitting round a table together, sincerely bringing their whole-hearted and united knowledge, experience, genius, and sympathy to devise ways of relieving the situation with expedition. Unless we are mistaken, the nation, irrespective of party, is in a more or less chastened mood, and as the subject of unemployment is our greatest and most urgent issue we should prefer to see a non-party inquiry held quickly and any practical and really promising measures proceeded with without delay.

We will only touch upon one other matter at the moment, hoping that that too will be regarded as non-political. We refer to something which it should delight the heart of this Government to make: greater progress than in the past in the Department of Overseas Trade. We are constantly hearing it said that the only practical remedy for unemployment is to enable British overseas trade to revive and thus produce work. A measure designed to this end was the appointment of an Economic Mission to Brazil and Argentina (ELEC. REV., May 31st, 1929, p. 948). Let the new Government appoint quickly a number of such Commissions to visit possible markets and report upon them without delay. Can we drop excessive Party feeling for a time and push our trade?

Callender's Meeting.

THE shareholders who attended last week's meeting of Callender's Cable and Construction Co., Ltd., must have been as gratified at the way in which the report was presented as at the satisfactory position which that report disclosed. Both Sir J. Fortescue Flannery, the chairman, and Sir Tom Callender, the managing director, made interesting comments upon the company's activities during the past year. We refer our readers to our "City Notes" for a report of the proceedings, but would like to mention one or two interesting points. The purchase of W. T. Glover and Co., Ltd., was an important development in which, apparently, some of the company's "friends" in the industry are participating, although the company carried out the million-pound transaction entirely on its own. The company can be congratulated upon a continuance of the flow of "bread and butter" orders to its works. It is this type of business which gives stability; special and large orders are, of course, very desirable, but they often mean a great deal of work for incommensurate profit and subsequent emptiness unless big contracts are ready to fill their space.

The chairman, in common with the heads of most other large electrical manufacturing concerns, stressed the importance to the company of its overseas business. It is always pleasing to hear of a British company strengthening and increasing its business in foreign and Dominion markets. Sir Tom Callender made a brief analysis of the company's overseas work during the past year. He "surveyed the world from China to Peru," and found Callender's in many places on the way—India, Burma, Persian Gulf, Jerusalem, Argentina, Chile, Brazil, South Africa, &c. A great deal of this business can be credited to Sir Tom's own activities. He has done for his company what a few other outstanding heads have done for theirs, and what we desire official Economic Missions to do for the country and its trade in general.

The B.B.C. Resignations.

THE series of staff resignations which has taken place at the London headquarters of the British Broadcasting Corporation lately, culminating in Captain P. P. Eckersley's resignation of the post of chief engineer as from the end of September next, has caused considerable concern in public and technical circles alike. The termination of the services of important officials who have helped in no small measure to build up an organisation that is rendering public service and is regarded all over the world as an example to be emulated, cannot be contemplated without perturbation, and naturally causes one to wonder what the effect of the loss of men who have given long and good service will be on the future of broadcast radio-telephony in this country.

It will be recalled that some few years ago the National Physical Laboratory suffered a somewhat similar loss of skilled technical men who had proved their capacity because it was unable to pay salaries commensurate with those offered as an inducement to men of known worth to transfer their services to industry. In the case of the B.B.C., however, the suggestion that the financial consideration is one with which the Corporation is unable to compete cannot be seriously countenanced; the revenue derived from the service by the Corporation and the Treasury, through the General Post Office, is very considerable, and the proportion allocated to salaries is by no means clear from the published accounts. Moreover, hints and insinuations relative to recent "incidents" at headquarters are too persistent to be ignored altogether. Public fear that the intricate organisation may be jeopardised is not to be wondered at, and its anxiety to know the reason why can be well appreciated.

Interlinked Swiss Stations.

One of the most recent electrical developments in French Switzerland has been the interconnection of the transmission systems of two Swiss companies.

By H. EALES.

THE Swiss "Compagnie Vaudoise," with its important power-station of Peuffeyre (of which mention has already been made), has made arrangements whereby the transmission system of the former can be linked with those of its other stations. Not only so, but by an agreement with the "Energie de l'Ouest Suisse" Company, the energy can also be transmitted to the Geneva-French frontier, thence to be passed on to a French company at Bellegarde, to which the Compagnie Vaudoise, subject to exportation laws, has promised as much as 25 million kWh per year for a period of ten years, with a maximum demand of about 3,500 kW.

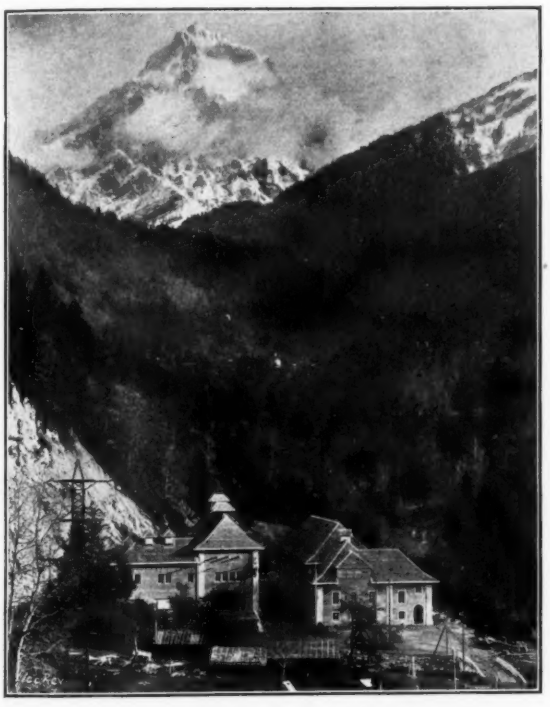


Fig. 1.—The Peuffeyre Power Station.

In order to carry out this plan successfully, certain adjustments have been necessary between the two Swiss companies, and the Compagnie Vaudoise has had to install a branch-line from Peuffeyre, fig. 1, *via* Malapalud-Montcherand, fig. 2, to the E.O.S. station at Romanel, whence the energy is conveyed to Geneva and across the frontier. By the agreement with the E.O.S. the Compagnie Vaudoise must so arrange its regulation that the power factor at which the energy is furnished at Romanel will correspond with that of its customers, which is guaranteed by the latter to be at least 0.85 at the Geneva-French frontier. The electricity supplied by the Compagnie Vaudoise must be at a pressure of 58 kV, the variation not to be more or less than 3 per cent., for the use of the Bellegarde Company, but the E.O.S. reserves to itself the right to raise that pressure to about 110 to 120 kV. The figures corresponding to these exchanges are as follows:—

Summer: Peuffeyre will yield from 0 to 11,000 kW over the Peuffeyre-Malapalud-Moncherand cables, divided thus: from 0 to 4,000 kW over the Malapalud to Romanel line, and from 0 to 11,000 kW over the Malapalud-Montcherand-La Dernier route.

Winter: a yield of from 0 to 5,000 kW by the works of La Dernier-Montcherand over the Montcherand-Malapalud-Peuffeyre lines, divided thus: from 0 to 3,000 kW over the Malapalud-Romanel cable, and from 0 to 2,000 kW over the Malapalud-Peuffeyre-Sublin route.

The Compagnie Vaudoise has installed a regulating station at Malapalud, capable of compensating for the variations of the voltage of the E.O.S. lines and those of the company, thus furnishing a junction between the two lines, and at the same time allowing a certain independance to each concern; the line thus works at a constant voltage between its two ends, Peuffeyre-Malapalud, with zero potential drop between them. The pressure on the line Peuffeyre-Montcherand is regulated automatically at the Peuffeyre works by varying the excitation of the alternators, and at Montcherand by means of a synchronous auto-transformer of 5,000 kVA installed in a sub-station close to the Montcherand works, so organised as to be used as a transformation, regulation, and distribution station. The connection of Moncherand with La Dernier, some 13 km. away, is insured by two overhead three-phase wires at a pressure of 40,000 V, with the neighbouring works of Montcherand by means of two underground three-phase cables at 13,500 V, and with the chief station of the Peuffeyre by means of overhead three-phase wires at a pressure of from 60,000 to 120,000 V. Engineers visiting Bex, or Glion, or the Rhone Valley, have no doubt admired the excellent installation at the Peuffeyre power-house, situated in that charming part of the canton of Vaud, with fine views over the Alps, and the Lake Léman.

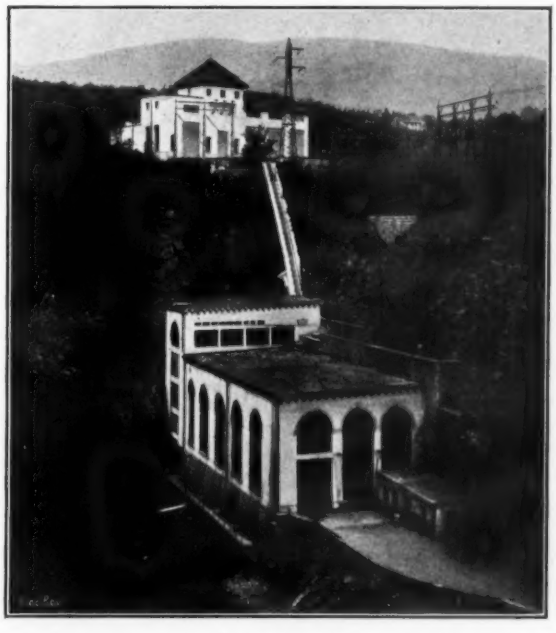


Fig. 2.—The Montcherand Installation.

The chief characteristics of the transformers at Montcherand are 5,000 kVA power for each three-phase winding, with a frequency of 50 cycles per second and a weight of 48 tons, oil included. Short-circuiting dis-

tortion is avoided by means of a special spring-arrangement, preventing any possible distortion of the limbs.

Besides the synchronous compensator already referred to, of a forced ventilation type, running at a speed of 750 r.p.m., with an applied pressure of about 13,500 V

40,000 V from the principal transformers, and the outgoing circuit for the feeders supplying the line at the same pressure, variable according to the load of the feeders. This apparatus is calculated for 10,000 kVA, and both regulators are driven by a little three-phase

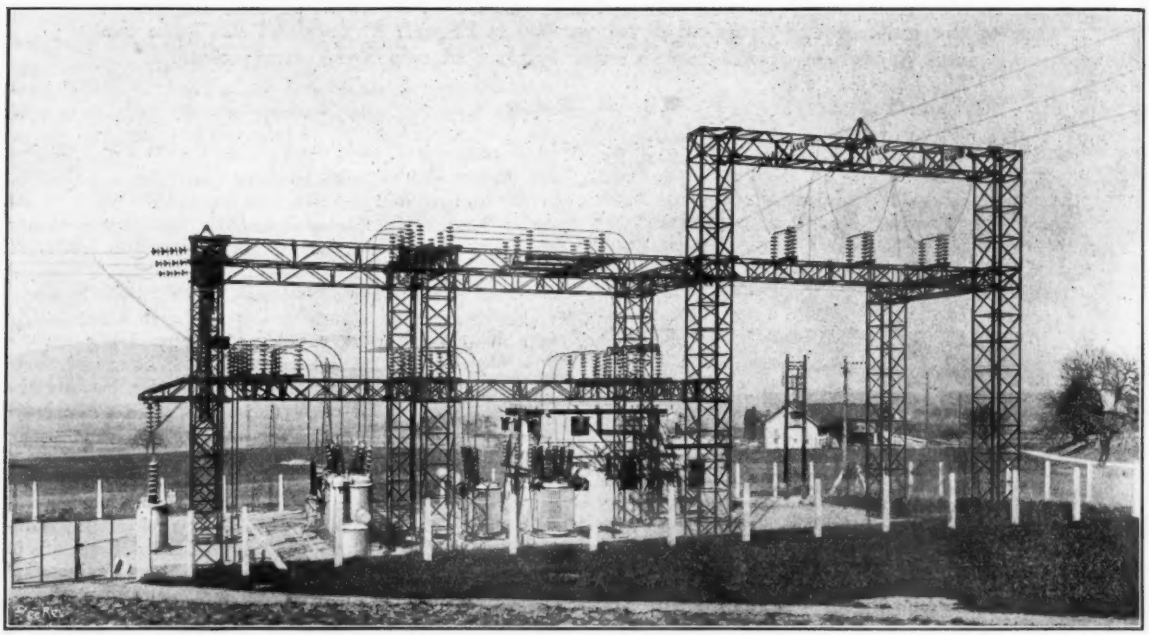


Fig. 3.—The Malapalud Sub-station.

on the current produced, there are two induction regulators for three-phase at 50 periods per second. One of them is branched between the circuit regulated at about 13,500 V of the principal transformers and the circuit of variable pressure (12,000 to 14,000 V) of the alternators of the Montcherand power-station. The function of this particular induction regulator is specially to limit the action of the synchronous compensator to the

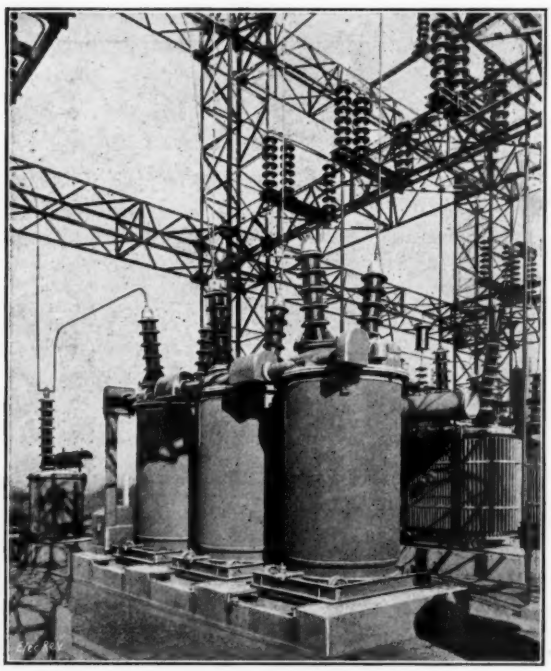


Fig. 4.—The Main Circuit Breaker.

yield of wattless current necessary for the Montcherand-Peuffeyre line to the exclusion of that absorbed by the Compagnie Vaudoise. The other induction regulator is branched on between the circuit regulated at about

motor. All the machines are furnished with thermometers, and an automatic electric warning is conveyed to the Montcherand works when the oil overheats.

The arrangement of the Malapalud station is somewhat different, as the latter is an outdoor sub-station, fig. 3, in the open country, situated at the juncture of the 58/116-kV Peuffeyre and Montcherand line, forming the link between the Compagnie Vaudoise and the "Energie de l'Ouest Suisse," at the point where the voltage of the latter line is the same, *i.e.*, Fully-Romanel-Geneva.

It has been installed in order to regulate automatically the power-factor between the two systems, and has a

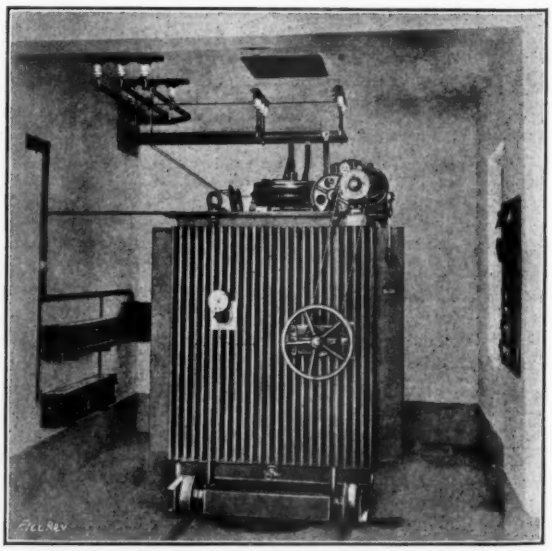


Fig. 5.—A Regulating Transformer.

powerful quick-break switch of 120 kV, as well as the parallel connection necessary for operating the link between the two systems. The regulation of the power-factor is insured by a three-phase oil-immersed in-

duction-regulator with a nominal capacity of 4,700 kVA. The pilot-motor of the machine is driven by a p.f. regulator in such a way as to keep the power-factor of the Malapalud-Romanel line at a predetermined value that is adjustable at will. All the machinery, together with switchboards, storage batteries, &c., is housed in a small stone building, while the 120-kV switch installation is in the open-air. The induction-regulator is branched on to the 58/116-kV Malapalud-Romanel line by means of two transformers as follows:—(*a*) An oil-immersed three-phase excitation transformer of 360 kVA for feeding the rotor of the transformer. It also comprises a coil at a pressure of 100 V which furnishes the current necessary for the p.f. regulator and for the synchronising instruments; (*b*) a three-phase oil-cooled series transformer of 410 kVA to feed the stator of the regulator.

The outdoor installation comprises the principal oil-cooled circuit-breaker of 350 amperes, fig. 4, with a short-circuit breaking capacity of 3,200 A, consisting of three single-pole sets connected mechanically. The apparatus is shock-proof, and operated by a servo-motor. Starting takes place under maximum current by means of relays set up in tanks, and acting upon time-relay regulators placed in the starting-box. The starting-spool is fed with direct current at 40 V, yielded by the accumulator batteries. This switch is connected electrically with that of the rotor of the induction-regulator, so that it is the chief switch that is set going first, thus starting the circuit-breaker of the rotor. The total losses in the regulator and the two transformers are 17 kW at no load and about 37 kW at full load.

There are three other transformers, *i.e.*:—(*a*) One single-phase oil-cooled pressure transformer for feeding the synchronisation instruments; (*b*) two oil-cooled current transformers with a yield of 25/5 A and 50/5 A, according as to whether operation takes place at 116 or 58 kV, to feed the p.f. regulator. By a system of bus-bars and section-breakers one can switch off the whole installation of the power-factor regulating gear should trouble arise, and in the case of the latter getting out of order the connection between the two systems can be ensured through the principal transformer.

The illustrations are reproduced by courtesy of M. Demierre, editor of the *Bulletin Technique de la Suisse Romande*, and of M. Nicole, director of the "Compagnie Vaudoise."

Applications of the Willans Line.

The significance of graphs and the indications they are capable of providing of the operating conditions of an electric power station.

By ROY BALDWIN.

THE use of graphs in practice is frequently avoided on account of the trouble of drawing them. Many of us have our doubts about our capability of drawing a symmetrical curve by freehand, and standard curves are not always at hand, yet the practical utility of graphs is well recognised. Graphs may be divided into three classes: (*a*) regular curves, (*b*) irregular curves, and (*c*) straight-line curves. The last mentioned are the simplest to draw and the easiest to understand; and it is best to use them whenever possible.

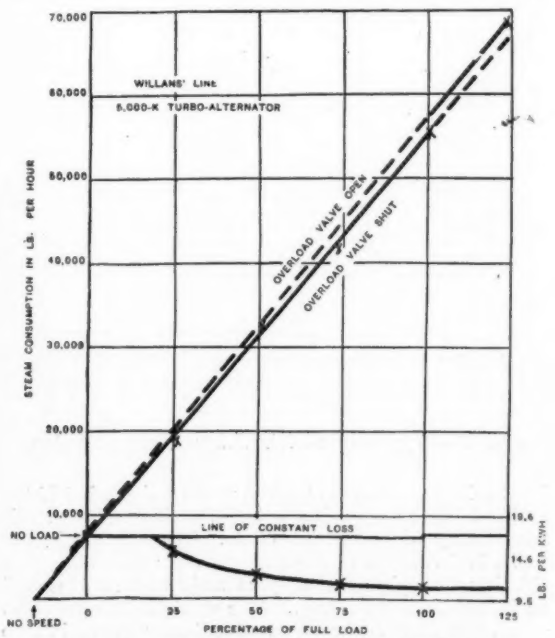


Fig. 1.—Willans Line for 5,000-kW Set.

If a straight-line graph is drawn of the total consumption of a turbine, and the line produced until it cuts the zero ordinate, the result is what is known as a Willans line. Mr. P. Willans first used this particular type of graph in relation to high-speed engines, but it is now frequently used for turbines. Fig. 1 shows a Willans line for a 5,000-kW set; the average line has been drawn from the consumption figures, and produced until it cuts the ordinate, that point indicating the steam consumption of the turbine when running light, and it may be checked by actual test. Produced further, the line reaches the abscissa at a point at which the speed of the turbine is zero.

The formula of the curve is of the nature $y=a+bx$, the constant losses, or the steam consumption at no load, being represented by a and b, is the slope of the curve, which is the tangent of the angle multiplied by the ratio of the scales used. Thus in this particular instance the formula is—

$$\text{Steam consumption} = 7{,}500 + 9.6 \text{ kWh}.$$

It will be noticed that the overload test is on an entirely different line, having a formula of its own. This is due to the fact that there is an extra set of nozzles in use; the no-load consumption is thus increased, due to the extra friction of the steam, and the slope of the curve is slightly raised. It is obvious that the two lines must meet at the point of no speed. The dotted part of the overload line is the estimated consumption at the various loads with the overload valve open.

It is often desirable to compare the steam consumption per kWh at various loads, and it may be done by a further construction. From the previous formula, where x = total kWh, the total consumption $= a + bx$. Dividing by x we get—

$$\text{Lb. per kWh} = \frac{\text{Total consumption}}{\text{Total kWh}} = \frac{a+bx}{x} = \frac{a}{x} + b.$$

Thus b is now the constant figure and it may be imagined as the theoretical consumption at infinite load. The varying factor is merely the no-load value divided by the kWh. Thus, if a line of constant loss (or a) is drawn across the graph from the no-load point, a curve a/x may be drawn in the enclosed space, and if the

valuation of the base line is fixed at b instead of zero, a consumption per kWh-curve is obtained which has been corrected to the Willans line. Such a curve is shown in fig. 1; for convenience the scale has been increased a hundredfold.

It will be noticed in the figure that the line of constant loss for overload rises on account of a being greater;

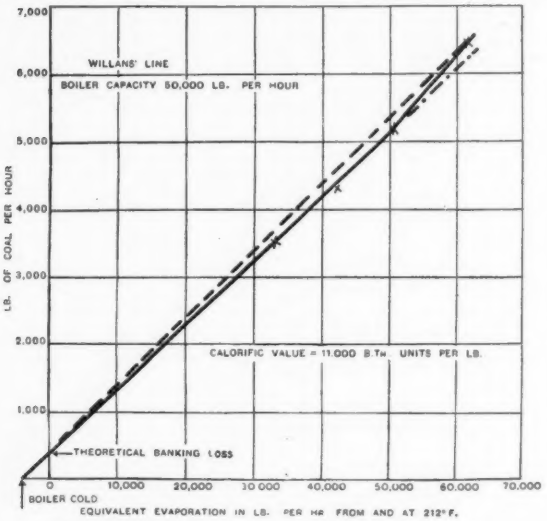


Fig. 2.—Willans Line for 50,000-lb. Boiler.

similarly, the consumption curve a/x will be slightly higher. There is also another addition that should be made due to the value of b being larger. This further correction may be avoided by drawing the curve higher, or, for practical purposes, it may be neglected.

A multiple-nozzle-governed turbine may be regarded as a machine with a series of overload valves; thus a series of steps will be obtained such as shown at full load in fig. 1. An average straight line drawn between the test points will give only approximate results. There is no single formula for such a case, but a number of formulæ with the constants increasing as each fresh nozzle comes into action.

Owing to the practice of only testing boilers in the region of full load, the utility of the Willans line for this purpose is not so great; however, the law still holds true and an example is shown in fig. 2. The calorific value of the coal in this case was 11,000 B.th. units per lb.; the coal for all four tests was taken from the same consignment and the laboratory analysis of the various samples closely agreed.

It will be seen in fig. 2 that the overload test is considerably above the projected average line, due to increased losses, such as unburned coal in the ash. It might seem at first sight that this is a parallel case to that of fig. 1, but it is not so. The opening of the overload valve of a turbine immediately alters the factors of the line, which remain constant with a varying load. In the case of a boiler, however, the factors are altering with every variation of the load, so the correct line is a curve upwards from the point of highest efficiency. For practical purposes this line may be drawn straight, generally from the full-load test figure as shown in fig. 2, although it must be remembered that this part of the graph does not follow the $a + bx$ rule.

Having shown that the consumptions of both turbines and boilers may be reduced to the Willans line with some measure of exactness, one naturally wonders if such a line may be drawn for the station as a whole, showing the relation between the coal consumption and the energy generated. If the calorific value of the coal is subject to wide variations, the figures will not follow the straight-line law. If the heat in coal varies 1,000 B.th. units, there will be an error of approximately ± 5 per cent., but in practice this discrepancy might not be so great, as when the quality of the coal increases the stoker, from habit, tends to keep the grate speed and thickness of the fire the same, unless the efficiency of combustion has been carefully watched. The use of old and inefficient plant over a long period and inefficient combustion also cause variations in the straight-line law, but these errors tend to even out in the long run.

If the input of coal and the output of electricity are reduced to the same common heat unit, variations in the calorific value of the coal will be automatically allowed for. In fig. 3 the unit chosen is 10^9 British thermal units: as in fig. 1, the a/x curve has been drawn in the area of constant loss and the value of the base line fixed at b; the scale is doubled. This curve gives the heat units of input required per heat unit of output, and the reciprocal multiplied by a hundred gives the thermal efficiency of the station; $100/b$ gives the maximum efficiency possible under the present conditions, but this must not be confused with the theoretical maximum efficiency, which is quite a different thing.

Another method of correcting for the varying heat content of coal is to base the line on the equivalent calorific value. It is not surprising that owing to the lack of standardisation in the chemistry of coal, equivalent figures are seldom used, yet equivalent evaporation has been in use for many years. In fig. 3 the same line may be used for the coal consumption in 10^5 lb. for an equivalent calorific value of 10,000 B. th. units per lb. Lines for other equivalent values may be drawn radiating from the point of no input.

The principle of the straight line may be also applied to the financial side of the undertaking with sufficient accuracy to be of interest, and in this respect it bears a resemblance to Pareto's law in economics. The capital charges, &c., will naturally form part of the constant costs. Repairs and maintenance will increase both of the constants, if the charges have been properly allocated, as, strictly speaking, they are a factor of the output. For instance, if a boiler has to be rebricked in a certain month, the cost should be spread over the months that the boiler has been working, not charged to the month when the repair was made; this may need a little extra calculation, which is necessary if accurate figures are to be arrived at. The cost of the coal is sub-

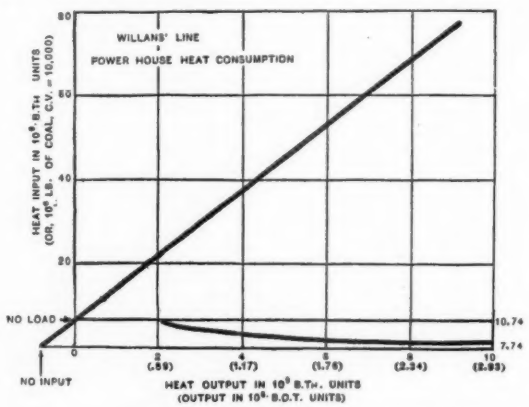


Fig. 3.—Application of W.L. to Power Station.

ject to the same source of error as the weight, but if the coal is bought on a calorific basis, as it should be, this irregularity will no longer occur. The constant loss of coal will form part of the constant cost; thus when considering a supply on a two-part tariff basis, this should be included in the charge. The straight-line graph of costs clearly shows the object of splitting the tariff into two parts, and it could be used for convincing consumers.

In conclusion, it may be said that the usefulness of the Willans line is becoming better known. Many of the large power stations in this country and on the Continent recognise it as a standard form for recording data, and the formulæ derived therefrom are confidently used. Thus, one may look to its increase and extended use in the future.

Amalgamation and Specialisation.

A Weakness of Modern Industrial Conditions.

By H. C. PARSONS, F.I.S.A.

WE are to-day living in an age of amalgamation and specialisation. In every trade, profession, and industry the modern tendency is to split up the organisation into sub-divisions, each dealing with a particular portion of the trade, or profession.

This state of affairs is largely the result of amalgamation amongst our large industrial concerns, and the formation of combines having one huge head office and one centralised organisation, for controlling the whole of the business incorporated in the combine. It is interesting to consider for a few moments the effect of this particular aspect of specialisation and sub-division upon the future requirements for all-round capable commercial men.

Economically, specialisation is the concentration on and perfection of one particular phase, or function, of industry, and as each industry, or trade, is in itself specialised, so does each of the different departments to which the various portions of work are allocated become specialised in its own particular sphere. The old order is rapidly giving place to the new, and the capable all-round business man who could take charge of the complete business machine is slowly, but surely, giving place to the young departmental head, who has not had the advantage of a good all-round routine training in the various functions of his company's business, but has specialised in one particular branch, be it buying, accountancy, advertising, salemanship, or any other of the multifarious branches comprising a modern industrial organisation.

To a large extent offices and factories are becoming "mechanised" and the human element is being reduced to a minimum by making the being practically as much a machine as the one he, or she, operates. There is hardly any phase of office routine work that the machine has not invaded. Adding machines, calculating machines, time clocks, addressing machines, stamping machines, and others, all carry out operations formerly done by book-keepers and other clerks. By the use of such aids to efficiency persons operating them are in time bound to become experts in their alloted tasks, and whilst this certainly tends to cheapen labour, to reduce the margin of error to which the human element was always subject, and to execute the work more quickly, it does not tend to the same all-round efficiency, or personal interest, in the work that was conduced by the older order of things.

Whilst it is fairly easy to obtain and train a routine worker for one or more of the various duties in an office to-day, it is much more difficult to find an all-round expert for the control of the routine work of various departments. The writer does not for one moment wish in any way to deprecate the use of modern office machinery, which undoubtedly is a great boon, nor the very efficient organisation of many of the great industrial combines, but simply to point out one great weakness that is bound to make itself felt in years to come, unless opportunities are given the rising commercial generation to gain more all-round experience.

It is possible, of course, for any young man to gain all-round theoretical knowledge of the various phases of business life whilst carrying on his duties as a specialist in one, but, if he is on the staff of a large combine, his opportunities for practical experience in other departments will be very limited. It is here that the up-to-date private firm can afford ambitious young men, and women, opportunities for gaining all-round experience that would be denied them by the larger concerns. In the majority of cases the commercial managers of the smaller companies have been through several, if not all, the different departments of the organisation, and therefore have a practical knowledge of the whole organisation, although perhaps not expert at some of the routine work.

It may be argued that the executive head of the office should not be concerned with the routine work of the organisation, but should apply himself to the higher and more complicated phases of the business. This point must of course be considered, but the commercial manager who has had no experience of the routine work of his organisation, and has to entirely rely upon others to control it, is not likely to be head of an efficient and contented staff, unless he is very lucky in his choice of departmental heads, or is able to pay salaries to attract the best men to his business.

The same weakness is apparent in workshop and factory practice as in the office. To be a really efficient and all-round engineering works manager, for example, will require many years of practical workshop experience, experience that it will be hard to get even with personal self-sacrifice for a few years. Modern requirements are so specialised to-day that it requires years to acquire a good working knowledge of machine-shop practice, tool-shop practice, foundry work, pattern making, and drawing office work, before an efficient all-round works manager can be produced.

It is the avowed practice of some of our industrial concerns to take young men from the universities and train them for the higher posts by putting them in the different departments for certain periods. Whilst this method may have its advantages from a social point of view, it hardly leads to the encouragement of ambitious young men who cannot claim the advantage of a university education, neither is it conducive to getting the best out of the executive staffs, who well know that their chance of attaining to the higher posts is very remote.

Not only is all-round practical knowledge to be considered, but also the effect of the various routine duties upon the staff. Some duties are undoubtedly monotonous and somewhat tend to depress the employé; it is here that a practical knowledge of the work is of considerable help in allotting the tasks to the most suitable workers.

Economists attribute a good deal of the prosperity of America to standardisation and specialisation of both industry and labour. Whilst both undoubtedly tend towards the cheapening of a commodity and higher efficiency in organisation, they also lead to a much larger number of purely routine workers in industry and a shortage of all-round experienced business men.

As previously mentioned, the writer wishes solely to draw attention to one of the weaknesses of modern commercial organisation, which, if continued, will tend to leave our future business heads dependent very much on an army of individual specialists for the running of their businesses, knowing very little themselves of the actual internal organisation of their own concerns.

D

Trade Marks and Trade Names.

In this article the author points out the differences, which are not generally appreciated, between infringement, trade libel, and passing-off in connection with trade marks, and also treats of registration in a general manner.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE number of legal disputes recorded in the columns of the ELECTRICAL REVIEW on the subject of the infringement of trade names and trade marks indicates one of two things—either that there is a growing inventiveness on the part of the members of the electrical world to such an extent that several inventors think out the same device at the same time (a thing not unknown), or that there is a widespread ignorance or disregard of the law relating to trade marks. Most probably it is the latter, for it is extremely improbable that the maker of an electrical accessory should quite by accident hit upon some trade mark or design which almost coincides with that used already by some well-established manufacturer of a similar accessory. Still, there are cases, especially in the matter of trade names, where an accidental coincidence may take place. In the electrical world descriptive names are necessarily limited, and such names as "radio," "magnetic," and "electron," while being themselves at first merely ordinary dictionary words, may acquire a certain trade significance when applied to the products of a certain manufacturer.

The basis of the law relating to trade marks is protection to the trader on the one hand and to the public on the other. Before the trade-mark legislation of the last century the trader whose trade name or mark was copied had to rely on the ordinary law of libel or deceit for his redress. This branch of the law was made applicable to such cases, first on the ground that the infringement of a trade name was a fraud on the public, and secondly on the ground that the issuing of an inferior article under the established name of another trader might be a libel on the trader whose name was used. The action for "trade libel" still exists. A leading instance is provided by the famous Thorley case, in which the proprietors of a cattle food issued an advertisement warning the public not to buy cattle food purporting to be "Thorley's" unless it bore the signature of Joseph Thorley. At the same time they issued a circular stating that another firm (named by them) was foisting upon the public an article which was not genuine. The firm named brought an action and won, on the ground of trade libel.

The law of deceit as applied to trade names takes the form of the familiar "passing off" action. This was commonly the action brought for the protection of traders before the Trade Marks Acts. It is still useful as being applicable to those cases where a trade mark has not been registered, or where the name or mark which is infringed is not such as could be protected under the Trade Marks Acts. The protection given to traders under these Acts is much better than that afforded by the old actions for libel or passing-off. For the protection is absolute. There is no need to prove deception (as in the case of the passing-off action) or to prove damage, as in the case of trade libel. All that has to be proved is that the offending trader has copied another's registered mark. This is not always an easy matter, although it may sound simple. Most of the trade-mark actions to-day are fought over the question of fact, whether the offending mark does in fact copy the registered mark, or whether the thing that is copied is part of a "trade mark."

It becomes necessary to consider at the outset what exactly a "trade mark" is. By Section 3 of the Act of 1905, a "mark" is "a device, brand, heading, ticket, name, signature, word, letter, numeral, or any combination thereof." A "trade mark" is a "mark used or proposed to be used upon or in connection with goods for the purpose of indicating that they are the goods of the proprietor of the trade mark by virtue of manufacture, selection, dealing with or offering for sale." The wording of this definition indicates another advantage which is given to traders by the Trade Marks Acts. A mark "proposed to be used" can be registered. It need not ever have actually been used. But in the old form of action for passing-off, the plaintiff must show that he has used the trade mark for such a length of time as to establish an exclusive right to it. Under the Trade Marks Acts no use of the mark need be proved.

The mark must be intended for use in this country, and if not used for five years after registration may be struck off the register. Moreover, the mark must be intended for use "upon or in connection with goods" for the purpose of showing whose goods they are. A mere name devised to indicate an invention, such as "leather cloth" is not a trade mark. But "Rexine," indicating a special manufacture of leather cloth, is a trade mark. The rule laid down by the judges is that "it is essential that the name should indicate not the article only, but also that the article is manufactured by the person claiming the trade mark." It is not, however, necessary that the actual name of the trader should appear. So long as the mark is used in connection with goods, it does not matter how it is used. It may be on the wrapper, on the article itself, or on a tag tied to the article. But it must always appear somewhere when the goods are sold. To put it only on the packing case where the public will not see it when the goods are sold over the counter will not entitle it to the rank of a trade mark.

Under the Trade Marks Acts a register is kept of all trade marks. A mark may be registered when it falls within the following classes:—(1) The name of a company or individual represented in a particular manner; (2) a signature; (3) an invented word or words; (4) a word having no reference to character or quality, and not being a geographical name or surname; and (5) any other distinctive "mark."

The invention of a trade mark is not so easy as might be supposed, and the register should be searched in order to prevent any collision with similar marks afterwards. The Registrar may refuse to register a mark on the ground, among others, that the mark is similar to one already registered; nevertheless, collisions do occur, and it is better to be wise before the event.

Registration in Part "A" of the register gives the applicant the right to the exclusive use of the mark for ever. But during the first seven years of registration the mark can be attacked by any person on the ground either that the mark was obtained by fraud, or that it is scandalous, deceptive, or immoral. And the correctness of the register may be questioned by any person who claims a superior title to the mark, or can otherwise show that registration ought not to have been made.

Part "B" of the register contains trade marks which were in use before the Act for at least two years. Registration in Part "B" confers only a limited right. When an infringement takes place, the mere fact of

infringement will not confer a right to obtain a legal remedy (as will registration in Part "A"). The defendant can show that, although his mark copies the registered mark, it is not such as would lead to confusion, nor is it calculated to deceive. So that no exclusive right is conferred by registration in Part "B," only a right to prevent deception or confusion. In this way the action for infringement under Part "B" is somewhat similar to the passing-off action. In both the question of deception is raised, and the action succeeds or fails on the strength of the evidence as to the deception of the public. In the trade-mark action the plaintiff has only to prove infringement, and the defendant must *disprove* deception; but in the passing-off action the plaintiff must *prove* at the outset that the defendant has deceived the public by the passing-off of his goods as those of the plaintiff. As to what actually constitutes an infringement, and the evidence which will prove or disprove it, is a matter for further discussion.

Teaching Electricity.

The author advocates the inclusion of "non-technical electricity" in the primary school curriculum.

By N.S.

ELECTRICITY in the school curriculum is not a suggestion; it is a necessity. The time has come when compulsory lessons in elementary electricity are as essential to the growing generation as lessons in civics and morals. To realise this, it is only necessary to consider how vital electricity has become in everyday life, and how deeply and thoroughly it has permeated the entire social and national fabric. Although the definition of electricity has so far proved an unsolvable riddle to engineers and scientists, all are aware of the illimitable benefits it confers on mankind, and that to-day it ranks as the most vital factor in improving the standard of living, and in adding to the comforts of all and sundry.

It does, or can, provide our homes with heat, our factories with power, and our homes, shops, factories, streets and even roads with light. It forms the basis of the telephone, wireless, and innumerable other conveniences of modern civilised life, which add so much to our comfort, or deduct so much from our daily expenditure of energy.

This is a time when much is being said and written about electricity—about the "Grid"; cheaper rates of charge; hire-purchase systems; methods of selling and of advertising. It is almost incredible that the simplest, cheapest, and most effective and permanent form of advertising has been overlooked. The juvenile mind is the most receptive, and no subject lends itself so well to being made attractive to the average boy and girl as "electricity in the service of man."

However, it is not from the point of view of advertisement that this article is primarily written, but because of the national necessity for the inclusion of the subject of electricity in the primary school curriculum.

It is axiomatic that if any radical reform in the social code is to be effected, the simplest and most successful method is by inculcating it into the minds of the younger generation. It is not suggested that a radical reform in electricity is necessary, but there is a necessity for a wider utilisation of its benefits, and a greater realisation of its potential possibilities.

Let us see first why electricity should be taught in the schools—then how it should be taught—and finally—what results we might reasonably expect from its teaching. Electricity has become part of "our daily bread." It touches the life of each individual in so many different spheres than an elementary knowledge of it should be in the possession of all.

In every field of activity where it has been applied, its beneficial influences have been conclusively proved. Its wider adoption is only limited or retarded by the "electrical" ignorance and indifference of the ordinary public. It spells advancement, and there seems to be ingrained in the human make-up a conservatism against all forms of advancement. Such conservatism can only be overcome by education—not, as many erroneously believe, by "push" sales methods or extravagant and indiscriminate advertising—and the obvious place to apply this education is in the primary schools.

If a general conception of electricity and its uses were implanted in the juvenile mind, it would be the first and most important step in eradicating conservatism, overcoming the present widespread indifference, and would tend to produce enthusiastic crusaders in the cause of electricity.

It is not a "dry" subject, and if properly presented, would prove so interesting that the young student would be anxious to delve deeper into its secrets and possibilities. We have only mastered the rudiments of electricity, and while present advancement is certainly rapid, it would be many times more so, if universal electrical education were adopted.

It is necessary that the public should be educated in regard to the cost of electricity, for the average man in the street does not view this matter in the correct perspective. Let teaching follow the line that the cheapness of electricity cannot be judged solely by £.s.d. standards, but by standards of life, of comfort, and of convenience, for the supply of electricity is not a commodity but a service; and that service which attains nearest to perfection in modern civilised life.

The main thing is not to teach the growing generation "electricity," but to teach it to think electrically and to live electrically. The more essential and simple elementary facts should be taught, but the main programme should deal with what electricity is doing for mankind, what it can do for mankind, and what it will do for mankind.

Stress should be laid on those little everyday applications of electricity which add so greatly to our comfort, convenience and amusement; on those bigger applications in commercial and industrial life, which add so greatly to our national wealth and have proved so vital in raising the standard of living of all grades of society; and on those finer applications in medical science and similar spheres, which are doing so much to alleviate suffering and to increase the individual and national welfare.

The inclusion of this extra subject will not lay a great burden on the teaching profession, for it is not suggested that any attempt should be made to impart technical knowledge of electricity to primary school children. Many of the leading men in the electrical world would not consider it beneath their dignity to compile for the guidance of teachers a small book which would adequately meet the requirements without loading it with terms or technical knowledge, which would confound the juvenile mind.

The direct result of this electrical education would be the gradual and sure elimination of the universal in-

difference, replaced by an enthusiasm for everything electrical. A wider knowledge would lead to the wider adoption of electrical methods with increased demand for electricity and electrical appliances. This is what all branches of the electrical industry are clamouring for, through all kinds of societies, committees, and advertising channels. The wider application of electricity will inevitably result in cheaper electrical supply and cheaper appliances. This is what the public is waiting for.

National interest would be a vital force in stabilising the electrical industry, which, by virtue of its innumerable ramifications is, or should be, the most vital industry to the nation.

Indirectly, this education will give an impetus to electrical research, invention and development, and it is difficult to anticipate just where electricity will stand when the present generation has grown to manhood. It is sufficient that it will be imbued with the electrical idea; and will be ever ready to contribute in all ways to this branch of science, which has already proved so vital to modern civilisation.

Radio Battery Eliminators.

Some notes and advice on the practical aspects of anode-circuit battery eliminators which should be serviceable to the user.

By F. E. SCHOFIELD, A.M.I.E.E.

ANODE-BATTERY eliminators are now considered to be a necessary part of the equipment of any wireless receiver having three or more valves, providing a mains supply of electricity is available. A properly designed eliminator is capable of superior performance to that of any form of h.p. accumulator, or dry battery, principally owing to the fact that a steady unfailing supply of energy is assured.

Now that a.c. is becoming recognised as the standard form of supply for general domestic use, and we are rapidly approaching a standardised supply voltage of 230 volts, it is becoming possible for the manufacturer to provide a standard eliminator. This will not only result in a reduced cost, but will eventually produce a more economical and possibly more efficient article.

Anode-battery eliminators can be divided into two sections: the rectifier, the sole function of which is to provide a unidirectional current; and the filter, which smooths out the irregularities of the rectified supply. The rectifier portion can be divided into two main types: valve rectifiers and metal-plate rectifiers. The valve rectifier scores on the matter of cheapness and, providing the maximum rectified current drawn from it does not exceed about 30 or 40 milliamperes, it gives a perfectly satisfactory performance. It is, therefore, the best type to use for the ordinary form of three- or four-valve set, using valves of the ordinary standard type. This form of eliminator will supply sufficient h.p. current to operate the usual forms of cone or horn types of loud-speaker, and give adequate volume for everyday household requirements. For the five- or six-valve superset, particularly when fitted with low-frequency valves of the super-power type, or when moving-coil loud-speakers are in use, the metal-plate type of rectifier is to be preferred. The latter form of rectifier is also to be preferred for large amplifiers for concert or dance halls and public-speaking equipment of the permanent (non-portable) type.

The metal-plate rectifier comprises a copper-oxide disk assembly which receives a supply of a.c. from a transformer at a pressure a little in excess of the desired rectified pressure. The difference between the two pressures represents the losses in the copper-oxide unit. This is the first advantage of the metal rectifier; it is possible to utilise a plain type of transformer with one primary and one secondary winding only, which not only ensures simplicity in the design of the transformer, with a consequent reduction in manufacturing costs, but also enables the designer to concentrate on producing a more efficient instrument.

The second advantage of this type of rectifier is that high plate voltages can be obtained for the last one or two stages of the amplifier without introducing excessively high transformer secondary pressures. In the case of the valve rectifier, using the standard form of full-wave rectification, the secondary of the transformer must be a centre-tapped winding, each half of which must give the required rectified pressure, plus an amount to cover the losses in the valve. Even for quite modest forms of valve-type eliminators it is possible to have a total pressure of 500 volts, or even more, across the ends of the secondary winding.

The amount of current which can be drawn from the copper-oxide rectifier is limited by the permissible temperature rise of the plates. If the temperature rises above the critical figure, breakdown of the oxide film is liable to occur and the rectifier may be permanently ruined. To guard against this possibility the rectifiers are carefully rated and marked with their carrying capacity by their makers and, in addition to arranging for the satisfactory ventilation and cooling of the elements, it is usual to stipulate a temperature rise which must not be exceeded under any condition. With these quite ordinary precautions the rectifier can be assumed to have an almost unlimited life, and with reasonable care will last for years. It is a simple matter to provide a sufficient number and size of elements to meet any ordinary demand, and currents up to 200 milliamperes, or more, can be very easily obtained at pressures up to 400 volts, if necessary. Providing the ventilation is efficient and the temperature rise is kept within the maker's limits, this part of the equipment, when once installed, can be practically forgotten. As regards cost, the metal-plate rectifier is obviously more costly to produce than the valve type, but against the cost we have to consider valve renewals and the extra cost of the transformer with its minimum of two centre-tapped secondary windings, one of which, as stated above, may have to withstand a working pressure of 500 volts, or more.

Referring to the filter, here there is more scope for the individual efforts of the manufacturer, but the basic principle covers a series of two or more reservoir condensers, and one or two smoothing chokes. It is customary to provide one condenser immediately after the rectifier and a further one after each choke. The larger the condenser the more even will the pressure curve become, but against this, consideration must be paid to the maximum output of the rectifier, to ensure that the latter itself, whether of the valve or plate type, is not overloaded at the moment of charging-up the condenser after discharge. It is usual in this country to confine the choke to the positive pole only, as this arrangement is found to give quite satisfactory results. When the supply is particularly "rough," and in almost all cases of d.c. eliminators, chokes on both poles may be used.

The last, and to the user the most important, part of an anode-battery eliminator is the means provided for obtaining different voltage tappings for energising the various valves, or stages. If the eliminator is to form an integral or permanent part of a factory-made wireless

receiver, the eliminator should be designed to feed one voltage only into the receiver, and the latter should be fitted with some form of anode-feed system. The most satisfactory arrangement is the method so ably sponsored by Messrs. Ferranti, Ltd.,* in which the anode supply to each valve, or stage, is fed through a separate wire-wound fixed resistance of a value suitable to the plate current and voltage of the stage, and each resistance is provided with its own individual by-pass condenser, connected between h.t. negative and the valve end of the resistance. This arrangement entirely prevents interaction, or " motor-boating " as it is more commonly called, from taking place; the unwanted h.f. component is harmlessly by-passed through the condenser to earth. There is, further, a distinct advantage in fitting these condensers as near to the valve circuit as possible, thereby cutting out long leads. From this point of view it is preferable to incorporate the resistances and condensers in the set itself, with a corresponding simplification of the eliminator.

When, however, the eliminator is designed to be retailed as a separate instrument for use with existing sets, it becomes necessary to introduce means in the eliminator to provide the various different voltages. It is a somewhat different proposition to design an eliminator that will be adaptable to all types of receivers. In contrast to American practice, it is becoming increasingly evident in this country that the simple potentiometer resistance as a means of obtaining a number of variable tapping points is not entirely satisfactory, and in certain types of receivers this method of tapping can be traced as a direct cause of instability. The most satisfactory arrangement, and the method which is now almost standard, is a modification of the anode-feed system, in which variable resistances of the carbon compression type are provided for each tapping required, and each resistance is fitted with its own by-pass condenser, connected between the receiver side of the resistance and h.t. negative. Variable resistances have the advantage that the anode voltage to each part of the receiver can be varied between quite wide limits, and the most satisfactory operating point obtained. The only objection which can be raised to this form of resistance is the risk of packing of the resistance material, which defect will not occur to any serious extent in a well made and well designed article, providing care is taken not to overload it. There, however, seems to be a tendency on the part of some makers to rate the capacity too highly, with the result that the resistance tends to run hot. This should be avoided, and if overheating occurs the current should be reduced by increasing the resistance, *i.e.*, turning the knob so as to reduce the pressure on the carbon contents. When anode-bend detectors, or screened-grid h.f. valves, are to be supplied it is preferable to provide means for preventing minute fluctuations in the anode current. It is usual in such cases to arrange for a suitable resistance to be connected across the full h.t. supply of the eliminator and to provide a tapping point, which may be either fixed or variable, to give the correct voltage. To prevent interaction, a separate resistance must be provided for each tapping required and each tapping must have a by-pass condenser connected as before described.

One defect of the present form of anode-battery eliminator is the inability to vary the maximum tapping voltage to suit the load on the eliminator. From the above it will be gathered that the maximum voltage which can be obtained from any particular eliminator is decided by the secondary voltage. Unfortunately, all wireless receivers do not require the same maximum anode voltage, and the amount of current necessary depends entirely on the number and type of valves fitted to the receiver. Owing to the inability to obtain perfect pressure regulation in the transformer, it is usual to find that an eliminator designed for a maximum output of 100 milliamperes at 200 volts will have a no-load e.m.f. of from 300 to 350 volts. If such an eliminator is connected to a simple three-valve receiver with a demand of from 20 to 30 milliamperes at 120 volts it is obvious that the maximum h.t. tapping will be at a figure too high for the set and an excessive strain will be put on the condensers and other components. It is useless to specify what the maximum current output of the eliminator is without providing a curve, or chart, indicating the output voltages at various loads from the maximum down to the minimum. Even when this data is available it is obvious that the resistances must be capable of absorbing an additional 100 to 150 volts if necessary. Several instances of trouble have come to the writer's attention from this cause. Either due to mistaken enthusiasm on the part of the purchaser, or inadvised pressure on the part of the salesman, eliminators have been purchased of comparatively heavy current outputs with a view to meeting future requirements, and the eliminator has been used for a time to supply two- or three-valve sets of the simpler types used in conjunction with small cone loud-speakers, and having a current demand of a quarter to half the maximum output available. In consequence, the receiver generally receives too high a plate voltage, unsatisfactory performance results, and the owner may be the victim of a very unpleasant experience if he is ill-advised enough to touch any part of the output side of the eliminator whilst it is supplying current.

Means should, therefore, be provided in every eliminator for adjusting the secondary voltage to suit the output of the filter section and to suit the immediate requirements of the user. This can be arranged by providing three or four tappings on the secondary winding and furnishing a table indicating the maximum h.t. output of each tapping and the pressure variation with various loads on each. An alternative method that is used to some extent in America is to fit a series resistance on the primary side of the transformer to permit of a certain amount of regulation being carried out without disconnecting the receiver, and if necessary without switching off the current. This resistance must, however, be of sound construction throughout, as it will be connected permanently on the mains side of the transformer and will have to withstand the full mains supply voltage to earth. The fixed tappings on the secondary winding would appear to be the most suitable arrangement for general use, as it does not entail any additional apparatus and cannot easily be abused. If, in addition, a complete chart, or curve, is provided for each tap of the secondary it will be an easy and interesting operation to select the most suitable pressure for each receiver, paying due regard to the maximum voltage demanded by the last valve and the total anode current required for all stages. The correct anode voltages for the intermediate stages would be taken care of by means of the existing variable resistances without any risk of overloading either the resistances or the valves.

* ELEC. REV., May 3rd, 1929, p. 807.

Motors for Colliery Winding Engines.

In a recent issue of *La Revue de l'Industrie Minerale*, Mr. Pauzat discusses the question of the use of asynchronous *versus* d.c. motors in connection with colliery winding engines. The author bases his remarks on the results obtained with the electrically-operated winding engines installed at the No. 4 and No. 5 pits of the Drocourt Co., one of which is operated by an asynchronous motor and the other by a Ward-Leonard type d.c. motor, the coal-raising operations at the two pits being practically identical. From the point of view of installation cost, the ratio is as 2 for the d.c. motor to 1.2 for the asynchronous motor; consequently to warrant the extra outlay, the d.c. machine should possess distinct advantages. The author admits that the d.c. motor is capable of great flexibility as regards range of operation, but he submits that the drawbacks of asynchronous motors in this connection have been greatly exaggerated. Another advantage of the d.c. motor is the possibility of recuperating energy on the descent of the cages, an advantage which is not possible with asynchronous motors, except at the expense of simplicity and strength. On the other hand, the consumption of asynchronous motors for similar work is 12 per cent. less than that of the d.c. type.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Cable Ferrule.

The object of an invention by Mr. P. L. DeVoy, 95, Milton Road, Stoke Newington, N.16, is to provide an improved metal ferrule for the jointing of electrical cables and wires, fig. 1. While the ferrule is cylindrical throughout its length and of a similar size to the cable to be jointed, an internal section of oval shape allows a space of 1/16 in. at either side of the cable for the insertion of molten metal through three holes in the body of the ferrule. A grub screw at equal distance from either end of the ferrule is provided for the purpose of securing the ferrule to the cable ends whilst jointing, and two pins of

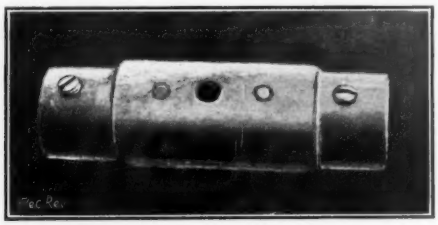


Fig. 1.—Cable-jointing Ferrule.

a similar dimension to two of the three holes in the body of the ferrule are provided; these pins are bullet nosed, so as to prevent them cutting through the wires when driven in. When the cavity inside the ferrule has been filled with molten metal, and before that metal has been allowed to cool, these pins are inserted in the two holes, making contact with the respective cable ends. The action of driving the pins into the interior of the ferrule distorts the cable ends out of their regular course and causes the wires to occupy the space of the oval cavity inside the ferrule, and any surplus metal is forced out of the remaining hole. The sweating of the joint is then completed and the ferrule and cable ends become one homogeneous mass, with the diameter at the centre of the ferrule of a larger dimension than that at either end of the ferrule. The possibility of the cables being drawn out through any exceptional stress is thus avoided.

Light-weight Motors and Generators.

The special feature of "Victory" d.c. machines, fig. 2, which are made by Messrs. R. W. CRABTREE & SONS, LTD., Water Lane, Leeds, for VICTORY DYNAMOS & MOTORS, LTD., David Street, Leeds, is their small weight and size for a given output and speed, making them specially useful for traction and marine work. The bodies are of high-permeability dynamo steel of special formation, so that the quantity of metal required purely for magnetic reasons is reduced to a minimum which, together with the special design and arrangement of poles, allows of great saving in weight and size, and ample room for all coils in very small machines, as well as in larger sizes. The core is built of thin laminations of annealed mild-steel of high permeability, insulated to reduce eddy-current losses, and truly balanced to prevent vibration and pressed up

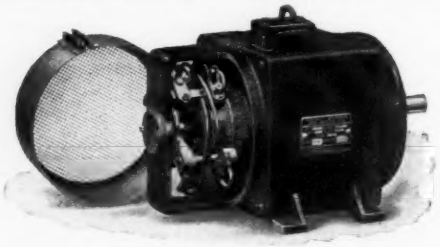


Fig. 2.—A "Victory" Machine.

under heavy hydraulic pressure. The armature coils are wound with double cotton-covered rectangular strip (except in the smaller sizes), on formers of special design to give coils exactly the shape required. The slots are skewed to make each coil enter the field smoothly to ensure silent running and assist commutation and stability. The commutator is self contained, and the socket is designed to admit the maximum quantity of ventilating air into the armature. Ball and roller bearings are fitted as standard, but plain oil-ring bearings can be fitted at the driving end if desired. A solid cast fan is mounted direct on the armature end support with well locked screws. The machines are made in seven frame sizes, covering capacities from 3 to 50 h.p. in the case of motors, and from 1¼ to 40 kW in the case of generators.

A Ring-main Isolating Switch.

In our review of the electrical exhibits at the North-East Coast Exhibition in our issue of May 24th, p. 940, we illustrated a ring-main circuit breaker which is being shown at the exhibition by Messrs. REYROLLE & CO., LTD., Hebburn-on-Tyne. We have now received the following particulars of the apparatus of this type produced by the makers. The isolating switches are of the oil-immersed quick-make and quick-break type, and are suitable for pressures up to 11,000 V. Separate switches are provided for each cable of the ring main, and each of these can be placed in any of three positions, namely, "on," "off," and "earth," a definite stop being provided so that it is impossible to move the switch accidentally from "on" to "earth." On changing over to the "earth" position, the cable concerned, having been earthed in this way, is safe to handle, and at the same time an interlock is released which makes it possible to remove a cover over a testing socket. A plug connector can then be inserted, and the cable tested, after the switch has been moved to the "off" position. The interlocking is such that the switch cannot be thrown over to the "on" position if the cover is open. If it happens that when a cable is being tested it is made alive from the other end, no serious damage results, because the testing plugs supplied are provided with a small air-gap to discharge any excess pressure. The switch-fuse for protecting the consumer's property is itself oil-immersed. The fuse elements are supported from a steel lid, and this is made to swing clear of all live parts when replacements are necessary, or when it is required to inspect the fuse. The whole equipment is very solidly constructed, and, since it is proof against flooding, it can be safely installed in underground manholes, or in other places where flooding is likely to occur.

A New High-Efficiency Telephone.

The convenience of telephones of the microtelephone pattern is generally recognised, but in the past their inferior transmission efficiency and articulation, as compared with fixed-

Fig. 3.—"Neophone" Non-Automatic Instrument.

transmitter instruments of the solid-back type, as well as their tendency to "howl" and "fry," has prevented their adoption for the public telephone service. As the result of a number of years research work, Messrs. SIEMENS BROS. AND CO., LTD., Woolwich, have, in co-operation with the Post Office engineers, produced the "Neophone," a telephone with an entirely new design of immersed-electrode inset transmitter which, in conjunction with a special anti-side-tone circuit, it is claimed, not only positively eliminates "howling," "frying," and excessive side-tone, as well as maintaining its efficiency, irrespective of the position in which the microtelephone is held, but is actually superior as regards articulation, and considerably better in speech-transmission efficiency than the standard solid back transmitter. As increased efficiency incidentally enables higher-resistance local lines to be employed without reducing the speech transmission efficiency, far-reaching economies in line plant may be effected. It is interesting to note that in the construction of the "Neophone" a moulded insulating compound has been largely employed, the case, microtelephone handle and the cradle all being made of this material. The pattern adopted by the Post Office uses a separate bell set, but a special design of bell set which can be used as a base on which to mount the telephone set, makes provision for a complete instrument for those who prefer the combined type. Fig. 3 shows a "Neophone" of the non-automatic type. Although the Post Office has placed a contract with the manufacturers for 50,000 instruments, it will, of course, be some time before they are available in sufficient quantities to meet the demand.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Wages in the Contracting Industry.

The National Federated Electrical Association announces that the rates of wages for journeymen electricians in the electrical contracting industry will be as follows as from the second pay-day in June (for the period covered by that pay-day), and will remain in force up to and including the period covered by the first pay-day in October, 1929:—Grade A: 1s. 10½d. per hour (including the increase of 5 per cent. which came into force on the first pay-day of May), representing a ½d. decrease; Grade B: 1s. 7½d. (no change); Grade C: 1s. 6d. (no change); and Grade D: 1s. 4½d. (½d. decrease).

This alteration affects the rates of plumber-jointers in the electric cable-making industry in the Greater London Area. The new rate for these men is 1s. 10½d. per hour, and that of plumber-jointers' mates 1s. 6d. per hour.

E.L.M.A. Activities.

In our last issue we made mention of the displays which the Electric Lamp Manufacturers' Association had arranged in connection with the I.M.E.A. Convention at Torquay. We reproduce herewith a view of the lighting room (fig. 1) arranged by the Association in the exhibition which was a feature of the Convention. An attractive brightly lighted centre-piece flanked by a recess containing examples of table lighting fittings, &c., occupied one wall. On another side two models, equipped with dual lighting systems, demonstrated good and bad lighting in factories and schools. Prominence was given to opal and Pearl lamps as a desirable alternative to the clear-glass type. In the centre of the ceiling a panelled fitting of modern design was fixed.

The Electric Lamp Manufacturers' Association has recently published two booklets which should prove of considerable assistance to contractors, supply authorities, and others interested in correct lighting. The first (Brochure 2) illustrates and describes the street lighting exhibit which has been arranged at the London Lighting Service Bureau. We dealt with this at some length in our issue of March 22nd (p. 517). The other (Brochure 3) deals with a series of window displays which E.L.M.A. has produced for electrical showrooms. The series comprises four sets, each of which is designed to demonstrate correct and incorrect illumination in certain situations. One of the sets is seen in the first illustration; another, in a window of the Torquay Corporation Electricity Department's showroom, is depicted in fig. 2.

Exide Convention at Brighton.

The annual Exide Battery Convention was held at Brighton on Monday, Tuesday, and Wednesday this week. At the opening of the Convention a civic welcome was extended by the Mayor of Brighton, Alderman H. J. Galliers, J.P., in the Royal Pavilion. Over four hundred "Exide" service agents attended the Conference from all parts of the British Isles. The annual Convention banquet took place in the Royal Pavilion on Tuesday evening. It is particularly interesting to observe that the Mayor, who spoke at the banquet, is the local "Exide" service agent.

The "Small" Manufacturers' Advantages.

In an article in a recent issue of *Printers' Ink*, New York, the general manager of a small electric motor manufacturing company in the United States gives his reasons for asserting the secure place of the small manufacturer in the business and economic scheme. Small overhead costs and the possibility of closer supervision and personal contact of the management with the employés are, he claims, great advantages. Also, generally speaking, the small manufacturer can turn out more product in value per employé per thousand man-hours of effort than can the larger firm. The suggestion is offered in the article that the small manufacturer should stop trying to compete with the large firm in the matter of price and should concentrate instead on lines where the large firm is vulnerable. Among these he mentions the greater opportunity for special service without demoralising the organisation, and the personal contact of the heads of the firm with buyers. A third advantage is greater adaptability, i.e., the shorter time required to reorganise for changes. This ability to make quick turns, it is pointed out, can be made to react considerably to the advantage of the alert small manufacturer

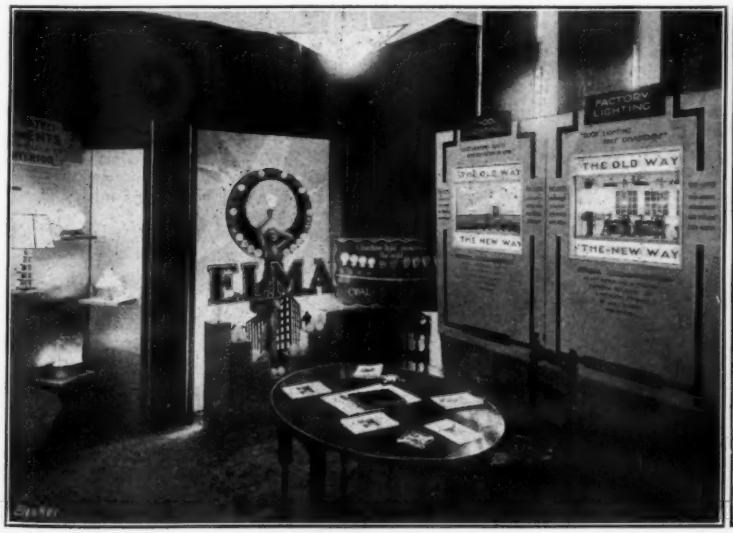


Fig. 1.—An E.L.M.A. Room in the I.M.E.A. Exhibition.

Fig. 2.—One of the E.L.M.A. Window Displays.

Patent System Reform.

The proposals for the reform of the British patent system recently put forward by the British Science Guild have been reviewed by a committee of the Bar Council, the members of which included Sir Duncan Kerly, K.C. (chairman), Mr. James Whitehead, K.C., the Hon. Stafford Cripps, K.C., and Mr. Trevor Watson. The views of this committee are of particular interest in view of the recent appointment by the Board of Trade of a Departmental Committee under the

chairmanship of Sir Charles Sargant, to consider the same subject. The Bar Council commends the report of the Guild, which was the work of a committee whose chairman was Dr. W. H. Eccles, F.R.S. Commenting on some particular points, the committee expresses the view that a patent ought not to be invalidated by mere "paper" anticipations—that is, by the publication many years ago of ideas which were stillborn and have never become known to the trade. It agrees that there should be stronger remedies against unwarranted threats by which persons wrongly claiming to possess patent rights may seek to prejudice rival manufacturers, and also supports the proposal that appeals from the decisions of the Comptroller of Patents should be heard by a special judge in chambers instead of by the Attorney-General or Solicitor-General as at present. The only proposals made by the Guild which elicit opposition from the Bar Council are those whereby the judicial duties of the Comptroller of Patents would be extended. They hold that he should not be empowered to act as a court of first instance for the trial of infringement actions; but they propose as alternative remedies for the admittedly high cost of patent actions (*a*) arbitration by consent of the parties, and (*b*) agreement between the parties whereby the issues to be tried in court should be restricted.

The Marking of Imported Glassware.

Following upon the inquiry into an application for an Order-in-Council requiring the marking of imported illuminating glassware, a Board of Trade committee under the Merchandise Marks Act, 1926, last week commenced the hearing of a similar application in respect of scientific glassware. The applicants were the British Chemical Ware Manufacturers' Association and the British Lampblown Scientific Glassware Manufacturers' Association. There were objections by the China and Glassware Section of the London Chamber of Commerce, the British Laboratory Ware Association, and other manufacturers' groups. Mr. Moritz, K.C., for the applicants, said that imported scientific glassware was already subject to a safeguarding duty. The applicants asked for the inclusion of silica ware in the Order. Counsel pointed out that before the war practically all of the scientific glassware used in this country was imported, but by the end of the war an industry had been created in this country. Already the British and the best Continental manufacturers marked their products, and as the glassware was already subject to Customs examination, the difficulty of enforcing a marking Order would be considerably lessened. Mr. Moritz further said that the applicants would be satisfied, in certain cases, with the marking of the containers. The two main trade unions concerned supported the application.

The opponents, while not objecting to the marking of specific articles, opposed the general marking of scientific glassware on the grounds of the cost involved, and stated that the marking of the glass would convey the impression that the whole apparatus was foreign. A number of expert witnesses gave evidence in favour of the application and were cross-examined by Mr. Macaskie, who appeared for the opponents.

On June 10th evidence was to have been given against the application on behalf of Philips Lamps, Ltd., but the applicants intimated that they did not object to the exclusion of X-ray tubes and protective lead glass from the proposed Order. Later in the proceedings it was stated that the General Electric Co., Ltd., was able to supply satisfactorily all the machine drawn tubing required. The inquiry concluded on June 11th and the Committee will report to the Board of Trade in due course.

Installation Work at Manchester.

The proposal that the Electricity Department should carry out installation work in municipal houses was again raised at a recent meeting of the Manchester City Council. The member who raised the matter said that this would provide a check upon private contractors, and prices would be reduced. Ald. Dagnall, the chairman of the Electricity Committee, said that the work would require the employment of a special staff which would at times have nothing to do. The proposal was rejected.

Salesmanship and Languages.

Speaking at the recent British Music Industries Convention, Mr. F. W. Goodenough, chairman of the Committee on Education for Salesmanship, said that the Committee's first step had been to arrange with the Board of Education to make an investigation of the methods of teaching modern languages in this country, and a comparison of our educational facilities with those of other countries. Too often the representatives of British firms did not speak or write the language of a potential buyer, and many export firms still conducted their correspondence with foreign buyers in English, quoted in English currency, and sent out wholly English catalogues.

Patents, Designs, and Trade Marks.

The 46th report of the Comptroller-General of Patents, covering the year 1928, has been published. It shows that 38,556 applications for patents were received (against 35,469 in 1927); provisional specifications numbered 24,071 (against 22,476); complete specifications numbered 24,045 (against 21,397); and 17,695 patents were sealed (against 17,624). There were 24,746 applications for the registration of designs (against 22,707), of which 23,899 (21,009) were accepted. Trade-mark applications numbered 12,684 (against 12,381) and 6,818 (against 7,543) were registered. The staff of the Patent Office totalled 698, and there was a surplus of receipts over expenditure of £147,840, the revenue amounting to £544,740. The report says that there are no striking developments to record. The increased activity in invention which has been manifested during the past few years was still more marked in 1928. At the commencement of this expansion in the numbers of applications, the greatest increase was shown in the chemical and electrical industries, but other industries have followed suit, and the activity is now widely distributed over the whole field of invention. In the electrical industries the developments in high-pressure distribution consequent upon the schemes of the Electricity Board are reflected in the large number of applications for protection systems and switchgear. There has been continued activity in dry surface rectifiers for electric currents. Automatic telephones, copying or picture telegraphs, and television apparatus show marked increases in the number of applications, and are responsible for increases in inventions connected with the speed governing and synchronising of electric motors. In connection with thermionic valves, the developments of the screened-grid and other forms of multiple-electrode valves and of valves with indirectly heated cathodes are prominent. Applications relating to electric heating are increasing, especially in respect of induction furnaces and apparatus for domestic purposes. The number of applications relating to gramophones and like sound recording and reproducing apparatus, including sound records and the associated working of such apparatus with kinematographs, is nearly double that of the year 1927. The main activity has been in connection with loud-speakers, electrical reproducing devices ("pick-ups") and synchronised sound and picture reproduction ("talkies").

Australian Electricians' Wages.

The March *Bulletin* of the Electrical Employers' Association of New South Wales shows that the rates of pay of electrical workers in the State are as follows:—Shift electricians, installation electricians, electrical fitters, battery fitters and cable jointers: £6 1s. per week, or 2s. 10 4/11d. per hour. Electrical mechanics and linesmen: £5 15s. per week, or 2s. 8 8/11d. per hour. Arc-lamp trimmers, £5 3s. per week, or 2s. 5 5/11d. per hour. Leading hands receive 9s. per week above their usual journey rates. Electricians in charge of plant with a capacity of less than 75 kW receive £6 6s. per week; and those in charge of larger plant, £6 18s. Labourers are paid at the rate of £5 per week. The wages of apprentices range from 16s. per week in the first year to 55s. 5d. in the fifth year.

Book Notices.

"E.T.Z. Gesamtinhaltsverzeichnis" (general index of the Elektrotechnische Zeitschrift for the 25 years 1903-1927 and of volumes 1-18 of the "Archiv für Elektrotechnik" and of the Verband Deutscher Electrotechniker "Fachberichhefte" 1926 and 1927). Issued by the Verband Deutscher Electrotechniker and the Electrotechnischer Verein under the editorship of Dr. Franz Moeller (Julius Springer, Berlin), 1928.—This large volume (653 quarto pages) forms an admirably arranged index to the 25 volumes of the "E.T.Z." ending in 1927, thus covering practically the whole of recent electrical engineering work in Germany and in most other countries. The first 76 pages are occupied by an alphabetical subject key index giving references to the actual index. Then follows the classified subject index arranged under 48 headings with numerous sub-sections. This occupies the next 386 pages. The book concludes with an alphabetical name index of authors' names and others. Every reference is to a year and a page in the volume for that year and also indicates whether the article is an original one, a reference, a letter, &c. The leading position which the "E.T.Z." has occupied for many years in German electrical engineering has ensured that practically all new work is recorded in its volumes so that this index should prove a valuable addition to the electrical reference books.

"Electrical Transmission and Distribution." By R. O. Kapp. Vol. VII. "Instruments and Meters." Pp. viii+276; figs. 23. Price 6s. net. Vol. VIII. "Auxiliary Plant." Pp. viii+130; figs. 10. Price 3s. net. London: Sir Isaac Pitman and Sons, Ltd.

"The International Aspects of Electrical Communications in the Pacific Area," by L. B. Tribolet. Pp. vii+282. London: Humphrey Milford. Oxford University Press. Price 11s. 6d. net.

"Faraday House Journal," Vol. xiii, No. 3, Summer Term, 1929.—In addition to the usual notes and notices, this issue contains a *frontispiece* portrait of Dr. A. Russell and the continuation of his article on "The Theory of the Transformer," which merits considerable attention.

"Ondes et Electrons." By P. Brigout. Pp. 245; figs. 57. Paris: Libraire Armaud Colin. Price 9 fr.

Great Britain's Radio Exports.

Statistics published by the *Wireless and Gramophone Trader* show that the exports of radio apparatus from this country during March were valued at £86,632, of which valves accounted for £13,994. The Netherlands was the principal market, taking goods valued at £17,472 (valves £2,533). Australia's share amounted to £13,459 (valves £3,090), and other leading customers were:—Argentina, £8,831 (valves

£735); Chile, £6,421 (valves £368); India and Burma, £3,985 (valves £313); Irish Free State, £3,919 (valves £755); France, £3,807 (valves £351); and Belgium, £3,547 (valves £543).

New Zealand's Electrical Imports.

The imports of electrical machinery into New Zealand during March last attained a value of £126,997, as compared with £154,000 in the corresponding month of 1928.

Trade Announcements.

RADIO INSTRUMENTS, LTD., 12a, Hyde Street, W.C.1, has appointed Mr. G. M. Paterson, 122, West Campbell Street, Glasgow, as its sole representative for Scotland.

The SOUTH-EAST KENT ELECTRIC POWER CO., LTD., has opened offices and showrooms at 4, The Exchange, Queen Street, Deal.

The TRENT ELECTRIC WIRE WORKS, LTD., has removed to larger and more central premises at 1, Dyott Street, Shaftesbury Avenue, W.C.1. (Telephone: Temple Bar 3791.)

MESSRS. WARD & GOLDSTONE, LTD., have opened a branch establishment at Upton's Yard, 49a, Briggate, Leeds, where large stocks of all the company's manufactures will be kept. The telephone number is 26812 Leeds, and the telegraphic address "Multum, Leeds." Mr. L. Kohn, who has been for many years the company's resident representative in Yorkshire, will be in charge of the depôt.

SPHINX ELECTRIC, LTD., Sphinx House, Hatton Garden, E.C.1, has appointed Capt. Gilchrist to represent it in Lancashire. His address is 14, Fountain Street, Manchester (Telephone: City 4208).

The Newcastle office of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., and METRO-VICK SUPPLIES is being transferred on June 17th to Metro-Vick House, Northumberland Road, Newcastle-upon-Tyne. (Telephone: Central 6202-5.)

Bankruptcy Proceedings.

R. BENNETT, wireless dealer, lately of 107, Devons Road, Bow, E.—A sitting of the London Bankruptcy Court was appointed to be held last week before Mr. Registrar Warmington for the public examination of this debtor, against whom a receiving order was made on April 23rd, at the instance of Brahams (Houndsditch), Ltd., creditors for £87. The Official Receiver reported that the debtor had not attended under the proceedings, and nothing was known regarding his present movements. The examination was adjourned *sine die*.

E. R. MILLWARD, trading as "West of England Radio," 67, High Street, Barnstaple, wireless engineer.—The public examination herein was to have been held on June 4th, but the debtor's solicitor produced a medical certificate and stated that the debtor would not be in a fit state to attend to business matters for three months. The hearing was adjourned.

J. A. HENDERSON (Hendersons), electrical contractor, 28a, Basinghall Street, E.C.—Receiving order made May 30th, on debtor's own petition. First meeting held June 12th. Public examination July 5th, both at Carey Street, W.C.

S. H. SKIPPER (S. H. Skipper & Co.), electrical engineer, 35, Broad Bridge Street, Peterborough.—First meeting held June 11th, at the Official Receiver's office, 41, Sidney Street, Cambridge. Public examination, July 12th, at the Law Courts, Peterborough.

H. A. HYDE, wireless dealer, late of 2, East Street, Bromley.—First and final dividend of 4s. 1½d. in the £, payable June 14th, at the Official Receiver's office, 29, Russell Square, W.C.

B. H. WISHAW, electrical and wireless engineer, Bakewell Road, Matlock.—First and final dividend of 1s. 3d. in the £, payable June 18th, at the Official Receiver's offices, 22, Regent Street, Park Row, Nottingham.

O. C. LAY (Home Wireless Installation Co.), accumulator specialist, 2c & 2d, High Street, Wandsworth.—**First and final dividend of 3s. 1d. in the £, payable June 19th, at the Official Receiver's office, 29, Russell Square, W.C.**

J. H. GORDON, electrical engineer, 21, Leeds Road, Ilkley.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds, released May 23rd.

H. NUTTALL (J. A. Hartley & Co.), electrical agent and factor, 1073, Chester Road, Stretford.—Trustee, Mr. F. Murgatroyd, Official Receiver, Byrom Street, Manchester, released May 29th.

A. M. EDWARDS (Mansell Edwards & Co.), electrical engineer, 111b, High Street, Blackwood, Mon.—Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff, released May 23rd.

A. H. CRUMP (Selwyn Electrical Engineering Co.), electrical engineer, 184, 202 & 220, Walworth Road, S.E.—First and final dividend of 4s. 7d. in the £, payable at Carey Street, W.C.

K. P. J. JOLIVARD, electrical engineer (K. Jolivard & Co.), 66, Victoria Street, S.W.—Application for discharge to be heard June 21st, at Carey Street, W.C.

P. L. LITTON (Moore & Litton), engineer, plumber, and electrical engineer, 12, Bath Road, and 50, Culverland Road, Exeter.—Trustee, Mr. W. R. Cocks, Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter, released May 23rd.

Company Liquidations.

ELECTRIC FACTORS (BLACKPOOL), LTD., wireless and electrical factors, 2, St. John's Walk, Blackpool.—The statutory meeting of creditors was held recently at Blackpool. Mr. James Todd, the liquidator, submitted a statement of affairs which showed ranking liabilities of £3,288, all of which were due to unsecured creditors, and net assets of £1,971, or a deficiency, so far as the creditors were concerned, of £1,317. The company was registered on January 21st, 1928, with a nominal capital of £500, the first directors being Messrs. H. Gilpin and G. Gilpin. Last October Mr. G. Gilpin died. Early in May a writ was issued against the company, and it was decided that voluntary liquidation should take place. The accounts to January 20th last showed cash sales of £1,024, and credit sales of £4,956. For the same period, the credit purchases were £5,711, and the cash purchases totalled £1,472. There was a gross profit of £2,545, but a net loss of £74. At the date of the liquidation there were 14 suing creditors. The deficiency was accounted for by loss on trading, bad debts, and goods loaned out on hire-purchase in respect of which records were not available. It was decided to confirm the voluntary liquidation of the company with Mr. Todd as liquidator, and an advisory committee was also appointed consisting of the representatives of Messrs. Corfield & Cripwell, the Chorlton Metal Co., and Mr. P. S. Booth. The following are creditors:—

	£		£
Abbey Cables, Ltd. ...	83	Mullard Wireless Service Co., Ltd.	46
British Electric Transformer Co., Ltd.	30	Metro-Vick Supplies, Ltd.	51
British Thomson-Houston Co., Ltd.	60	Bankers	735
Baugatz, L. (Berlin) ...	66	O'Brien, R., & Co. ...	93
Chorlton Metal Co., Ltd.	51	Pye Radio, Ltd.	42
Clarke, H., & Co., Ltd.	33	Philips Lamps, Ltd. ...	214
Celestion Radio, Ltd. ...	30	Rawson, H. G.	45
Efandem Co.	49	Reeves & Co.	39
Formo	32	Rhineland Cable Co. ...	46
Ferranti, Ltd.	57	Siemens Bros. & Co., Ltd.	74
Graham Amplion, Ltd. ...	45	R.I. & Varley, Ltd. ...	38
Gilpin, H.	379	Wright & Weaire, Ltd. ...	25
Harwell, Ltd.	32	Ward & Goldstone, Ltd.	33

E. O. JONES & SONS, LTD., timber merchants and electricity suppliers, Welshpool, Mont.—A meeting of creditors was held recently at Shrewsbury. Mr. C. S. Asbury, the liquidator, submitted a statement of affairs which showed ranking liabilities of £9,218 and net assets of £4,413, leaving a deficiency, so far as the creditors were concerned, of £4,805. The company was registered in August, 1925, and took over an existing business. The capital was £250, but was eventually increased to £5,000. The issued capital at the date of the liquidation was £4,150. It was pointed out that up to about September, 1927, the business showed a balance to the credit of profit and loss account of £90. The directors installed electrical plant for working the sawmill machinery, and also entered into a contract to provide a bulk supply of electricity to Welshpool. The installation of the necessary electrical plant and machinery was expensive; engines were obtained on the hire-purchase system, and an overdraft was obtained at the bank. The turnover since removal to the new works had been disappointing, and there had been losses. It was hoped that arrangements could be made for the sale of the electrical side of the business. It was decided to confirm the voluntary liquidation of the company with the present liquidator, and a committee of five of the principal creditors was also appointed.

JOSEPH TABBUSH & CO., LTD., wireless engineers, 11, Queen Victoria Street, E.C.—Under a compulsory winding-up order made against this company on February 11th, 1929, upon a creditor's petition, the statutory first meetings of the creditors and shareholders were held last week at Carey Street, W.C., before Mr. J. Barwick Thompson, Official Receiver. The company was formed in December, 1926, to carry on business as radio and electrical engineers. It appeared that no statement of affairs had been lodged, and in the absence of a quorum the meetings were formally adjourned. **A proof of debt for £640 was lodged on behalf of the petitioning creditors in respect of unpaid taxes.**

ATTAIX, LTD.—A meeting of members is called for July 8th at 32, Finsbury Square, E.C., to hear an account of the winding up from the liquidator, Mr. K. M. Scott.

GALLETTI'S WIRELESS TELEGRAPH & TELEPHONE CO., LTD.—A meeting of members is called for July 10th at the offices of Messrs. Kemp, Chatteris, Nichols, Sendell & Co., 36, Walbrook, E.C., to hear an account of the winding up from the liquidator, Mr. H. J. Page.

PRESTEIGN ELECTRIC CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. Stephenson, Victoria Hall, Llandrindod Wells.

EASTNOR TRAMWAY TRACTION & ELECTRICAL CO., LTD.—A meeting of members is called for July 6th at National Buildings, St. Mary's Parsonage, Manchester, to hear an account of the winding up from the liquidator, Mr. A. J. Adams.

Dissolution of Partnership.

RELIANCE ENGINEERING CO., mechanical and electrical engineers, 339, Richmond Park Road, East Sheen.—Mr. E. Pobjoy and Mr. G. T. Boote have dissolved partnership. Mr. Pobjoy will attend to debts and continue the business on his own account.

Unemployment.

The number of registered unemployed on May 27th was 1,132,300. This represented an increase of 27,638 since May 13th, when the total was 1,104,662. Figures are not available for the week ended May 20th (Whit Monday).

New Catalogues and Lists.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for June. A number of large "Osram" lighting installations are illustrated and described in this issue; there is a special article on the "Pearl Osram" lamp; and notes on the company's screen-grid receiving sets, installation accessories, cooking equipment, &c.

The company has also produced a brochure on street lighting practice containing illustrations of its standards and lanterns and views of actual installations.

TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD., 72, Oxford Street, W.1.—Two illustrated folders drawing attention to the reduced prices of the company's lamps.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4.—A well-produced booklet containing various tables of conductors, and a price list of "Callender" cables.

IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.—Leaflet No. S.5110 referring to Igranic newspaper conveyors and installations installed at Newcastle for the *Evening World*.

A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—A leaflet, priced and illustrated, drawing attention to the company's fans. Also a stock list of motors, domestic appliances, switchboard, instruments, &c.

BRITISH INSULATED CABLES, LTD.—Price list No. H.116 of cab-tire sheathed cables and flexibles. Publication No. C.101, describing the various applications of "Copperweld" material.

THE ARORA CO., Loughborough.—A pamphlet drawing attention to "Arora" cookers and immersion heaters. Illustrated and priced.

ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Three illustrated publications dealing with power equipment for all industries, Fullagar oil engines, and truck type switchgear.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, Charleroi.—Stock list for June of the company's motors, transformers, centrifugal pumps, &c.

MR. D. M. LUMSDEN, Millburn, Almondbank, Perth.—Two illustrated leaflets, with price list, describing the "Lumsden" quartz mercury vapour lamp and small sun lamp.

MESSRS. MAWDSLEY'S, LTD., Dursley, Glos.—A folder and blotter drawing attention to the company's motors. Also a map of the United Kingdom backed with a sliding card by which the distances between the chief towns can be ascertained.

CANTIE SWITCHES, LTD., Leighton Works, Carlton Road, Nottingham.—Leaflet No. 120, advertising "Cantie" ironclad switches.

Calendar-blotters for June have been received from the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1; POPE'S ELECTRIC LAMP CO., LTD., Elasta House, 5, Arthur Street, New Oxford Street, W.C.2; WARREN BROS. (MIDDLESBROUGH), LTD., 91 & 93, Grange Road, Middlesbrough; and MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.

JOHN THOMPSON WATER TUBE BOILERS, LTD., Imperial House, Kingsway, W.C.2.—An illustrated folder showing actual installations, and sectional drawings of the company's boilers.

Italian Foreign Electrical Trade.

The appended table shows the Italian imports and exports of electrical machinery and apparatus during the first quarter of the current year, as compared with the corresponding three months of 1928. The values have been converted to sterling at an exchange rate of 92.60 lire to the £. It will be seen that both imports and exports show an increase—the former of £129,148 and the latter of £124,879.

	Imports. Jan. to Mar.		Exports. Jan. to Mar.	
	1929.	1928.	1929.	1928.
	£	£	£	£
Accumulators and parts	14,824	6,290	4,304	15,163
Incandescent lamp bulbs	16,790	9,776	24	—
Electrical measuring instruments	13,003	6,276	640	125
Electrical apparatus, miscellaneous	185,953	138,066	28,518	28,342
Telegraph, telephone, and radio apparatus	292,562	212,458	4,533	7,406
Electric furnace and other carbons	40,194	29,006	1,485	2,097
Insulated cables	2,830	14,116	104,066	10,826
Generators, "without collectors"	49,854	65,769	4,062	4,323
Generators, with "collectors"	68,856	63,376	78,245	42,791
Glass and porcelain insulators	8,085	11,765	3,250	1,425
Arc lamps	80	56	—	—
Incandescent lamps	116,650	116,655	23,357	15,680
Static transformers	1,786	800	3,645	2,892
Insulating tubes	36	85	759	820
Electricity meters	28,188	36,232	525	132
Insulated wire	8,162	7,979	13,083	13,595
Totals	£847,853	£719,705	£270,496	£145,617

Social Events.

The tenth annual athletic sports meeting of the General Electric Co., Ltd., was held at the company's sports ground, Preston Road, Wembley, on June 7th. Although the event was not favoured with the brilliant weather which contributed so largely to the success of the preceding year's meeting, the rain which threatened held off and the extensive programme of 51 events was carried through without interruption. As in previous years, G.E.C. amplifiers were installed to assist the stewards in getting together the competitors for the various events, and in place of the usual band an excellent programme of music was broadcast by Gecophone Orchestrola equipment, the records being supplied by the Gramophone Co. Considerable keenness was displayed by the competitors, who were inspired to great endeavours by the enthusiasm of a large and appreciative gathering of employés and friends. The numerous and valuable prizes were distributed by Lady Hirst, who, with Sir Hugo Hirst, received an ovation. Sir Hugo, in thanking the company for their reception, briefly mentioned his visits to the various G.E.C. organisations in Australia, and the sports meetings held "down under." The day's proceedings were brought to a pleasant conclusion with community singing, interspersed with items rendered by G.E.C. artistes, and dancing on the green.

Brook Motors, Ltd., recently celebrated its 25th year of existence. The salesmen and branch managers were called together on May 27th for a conference, which lasted until the 29th. At this conference the various methods employed in the selling and distribution of electrical machinery were discussed. On June 1st all the employés and their friends were taken to Blackpool by special train, meals being provided both going and returning. A thoroughly enjoyable day was spent. For the twenty-fifth year in succession the company was favoured with a fine day—a remarkable record. The party arrived back in Huddersfield at about 11 p.m.

On May 29th, the first re-union dinner of the Association of Ex-Siemens' Men was held, with Mr. Frank Wallis (English Electric Co., Ltd.) in the chair. The hon. secretary reported the number of members who had joined, and a large number of names of probable members were suggested to him. Some fifty members attended the dinner and concert, and a very enjoyable evening was spent. Membership of the Association is confined to ex-members of the Siemens' organisations, and the qualification for membership is that applicants should have served at least one year on the staff of these organisations, the annual subscription being merely a nominal one. The hon. secretary is Mr. J. Snow Huddleston, Dagenham Dock, Essex, who will be pleased to give full particulars of the Association.

A cricket match between the works and office staffs of Simplex Conduits, Ltd., took place on June 4th, at Hall Green. The office batted first, securing only 44 runs. Although two works' members retired after a lengthy innings and one did not bat, the works score at the close stood at 131.

The fourth annual sports meeting of the Hackbridge Electric Construction Co.'s Sports Association is to be held at Molesey Road, Hersham, on June 22nd.

Recent Contracts.

The ENGLISH ELECTRIC CO., LTD., has received an order from the Darlington Corporation Tramway Department for six complete four-wheel, single-deck, railless 'buses. Each 'bus will have seating accommodation for 32 passengers. The equipment will consist of a single 60-h.p. motor and standard foot-operated controller, and rheostatic braking is provided.

Among the more important lighting installations recently carried out with "Osram" lamps and fittings made by the GENERAL ELECTRIC CO., LTD., are those in the Malvern Town Hall, Melbourne; the Plaza Cinema, Liverpool; and the Grosvenor Dancing Academy, Chester.

Messrs. W. CROCKATT & SONS, LTD., Glasgow, state that in addition to the order recently received from the well-known shipowners, Messrs. Hugh Hogart & Sons, for 30 of their "Simplex" valve reseating machines, they have just received an order for 13 similar machines from Messrs. Franco Tosi Societa Anonima, Legnano, Italy.

The South African Radio Market.

A South African correspondent of the *Times Trade and Engineering Supplement* says that although the Union market for radio apparatus is worthy of attention there are certain adverse factors which have to be overcome before there can be a great expansion of demand. The number of licensed listeners has grown very slowly and at the end of 1928 was only 16,710. The potential market is much larger, for the white population approaches 2,000,000, some 70 per cent. being outside the urban areas. There are broadcasting stations in Johannesburg, Cape Town and Durban, while others in Port Elizabeth and Bloemfontein are projected. The existing stations are difficult to pick up outside their immediate areas, due largely to atmospherics, and consequently five-sixths of the listeners are to be found in the regions near the stations. The sale of American sets is growing but English-made apparatus is in a strong majority; there is no local manufacture. "Super-selective" sets employing three or four valves are in demand and there is also a sale for super-heterodyne, "all-mains" and portable sets. It is pointed out that instructions and publicity matter should be in both English and Afrikaans. The

use of a number of available advertising media is advised. The writer thinks that much good might be done if a high-power short-wave station were erected.

For Sale.

Messrs. Henry Butcher & Co. will sell by auction at 126-128, New King's Road, Fulham, S.W., on June 19th, surplus plant, machinery, stock and stores of a motor-car accessory manufacturer. Aldershot Borough Council have for sale water tube boilers, chain grate stokers, feed pumps, steam dynamos, &c. (See our advertisement pages to-day.)

The E.C.A. and E.D.A.

At a recent meeting of the Council of the Electrical Contractors' Association it was decided to make a donation of £200 to the British Electrical Development Association, in addition to the annual subscription of £400, as in the previous two years. The Council also approved a donation of £50 to the Electrical Association for Women.

American Electrical Manufacturers' Organisation.

Formal approval has been given by the Board of Governors of the National Electrical Manufacturers' Association to the reorganisation of divisions each composed of a number of sections, or manufacturing industries, having related interests. This action is designed to more closely co-ordinate sectional activities. The divisions which have already been organised and are now formally approved are the appliance, insulating material, radio, refrigeration, transmission and primary distribution, utilisation and control, wiring devices and wiring materials. An industrial heating division and a lighting division have also been authorised, but are not yet organised.

The F.B.I. Delegation in Spain.

The Madrid correspondent of *The Times* reports that Sir George Grahame, the British Ambassador, entertained the delegation of the Federation of British Industries under Lord Gainford at luncheon on June 5th. The Ministers of Public Works and National Economy and several departmental officials were present. The delegates had their first contact with the Spanish Government on June 4th, and they were to leave for Barcelona on June 6th. The "frank and full" exchange of views has been limited to the presentation of the carefully-prepared *exposé* of the British case submitted to the Minister of National Economy, supported by some examples of tariff hardships. In a short speech the Minister of National Economy offered to employ his best endeavours to improve trade relations between the two countries.

Catalogues Wanted.

E.P.I., LTD., Inner Temple, Dale Street, Liverpool, ask for catalogues and prices, with full details, of small electrical refrigerator plants.

New Cable Factory in Sweden.

According to *Nya Dagligt Allehanda*, the Allmanna Svenska Elektriska, A.B., in addition to the enlargement and modernisation of its plant at Västeras, is to begin the construction of another large cable factory in the vicinity of Stockholm. This factory will not only supply the requirements of the A.S.E.A. combine, but will also produce for export.—*Reuter's Trade Service* (Stockholm).

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during April last amounted to £51,464, bringing up the total for the first four months of the year to £202,122, as compared with £151,600 in the corresponding period of 1928.

New Swiss Company.

A company has been formed at Schwanden, Glarus Canton, with the title of Die Sernf-Niederenbach Kraftwerke Gesellschaft, to establish a plant to utilise the water power of the Rivers Sernf and Niederenbach.

Swedish Electrical Exports.

The exports of electric motors, generators and allied machinery from Sweden during the first two months of this year reached a value of £237,720, as compared with £361,830 in the corresponding period of 1928. There was also a decline in the exports of Swedish telephone and telegraph apparatus from £97,630 to £71,150.

The Dutch Radio Trade.

According to the *Wireless and Gramophone Dealer*, the exports of radio apparatus from Holland during 1928 had a value of £1,833,335, as compared with £766,415 in 1927. France was the principal market, taking goods valued at £275,000; Germany (£233,330) was second and Great Britain (£205,830) third. Holland's imports of radio equipment were valued at £788,335, against £401,416 in 1927. Germany (£348,335) was the leading supplier, Great Britain (£146,665) taking second place.

It is stated by our contemporary that the Philips concern is making vigorous efforts to dominate the Australian market, and has made "amazing" progress during the past two years. This has caused the Americans to lose ground, but the British contribution to the trade is relatively small.

German Trade with China.

The report for 1928-29 of the German Chamber of Commerce in Shanghai deals, among other matters, with the trade in machinery for China, which is controlled from that port. The imports of electric motors and generators from Germany in 1928 are estimated to have represented about 16,000 h.p., including 2,500 h.p. in generators for central stations. Having regard to the unfavourable conditions prevailing, it is stated that the imports of German low-pressure apparatus, chiefly for telephony and telegraphy, could be considered normal.

Hungarian Electrical Exports.

The exports of electrical machinery and appliances from Hungary during last year attained a value of £669,910, as compared with £567,870 in 1927.

Patent Application.

Application has been made for the extension for a further period of 4½ years of patent No. 28,527, of December, 1913, granted to R. Amberton, for "Improvements in or Relating to Electrical Control Systems and Switch Mechanism therefor."

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price June 11th.	Fortnight's inc or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£18 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅞d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£1[c]4	£4 inc.
	Grade II... ... ... ,, ,,	£130	£3 inc.
	Grade III ... ... ,, ,,	£72	£1 inc.
c	Brass (rolled metal 2" to 12" basis) per lb.	10¼d.	...
c	,, Tubes (solid drawn) ... ,,	1/1 to 1/1½	...
c	,, Wire, basis ... ... ,,	11½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8½	...
c	,, Bars (best selected) ... per ton	£110	£2 dec.
c	,, Sheet ... ... ,,	£110	£2 dec.
c	,, Rod ... ... ,,	£110	£2 dec.
d	,, (Electrolytic) Bars ... ,,	£[c]4 15s.	5s. inc.
d	,, ,, Sheets ... ,,	£[c]43 10s.	...
d	,, ,, Wire Rods ... ,,	£91 15s.	5s. inc.
d	,, ,, H.C. Wire per lb.	11½d.	½d. inc.
f	Ebonite Rod... ... ... ,,	2/8 to 2/6	...
f	,, Sheet ... ... ,,	2/8 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	11½d.	...
l	Iron, Pig (Cleveland No. 3.) ... per ton	70s.	1s. 6d. inc.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£25	...
g	Mercury ... ... per bot.	£22 2s 6d. to £22 5s.	...
e	Mica (in original cases) small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6½	...
o	Platinum ... ... per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire ... ... per lb.	1/3½	½d. dec.
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton	£203 to £ 0[s] 10s.	£6 inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

In their letter dated June 8th Messrs. James Forster & Co. stated that the lead market remained very steady all last week with slight fluctuations. Although the General Election is out of the way and the reparations question practically settled, there is so far very little revival in demand from consumers, either in this country or on the Continent. The demand, however, has been slightly better, the Russians buying a fair quantity of lead in Germany, which has relieved the situation there, while in this country the home trade is busy, and booking moderate quantities of lead. The cable trade, however, is still out of the market for anything but small quantities. The tone of the market is decidedly steadier than it has been for the past few weeks, but ample supplies of metal are due to arrive before long from Australia, Burma, and Mexico.

Lighting and Power Notes.

Australia.—NEW SOUTH WALES.—A Bill has been introduced in the New South Wales Parliament, states the *Electrical Engineer of Australia and New Zealand*, to authorise extensions to the Port Kembla steam generating station and electrical distribution system of the Public Works Department. The station has at present an installed capacity of 8,100 kW, but provision is to be made for extension to 25,000 kW as required. It is proposed that the distribution system, by means of which bulk supplies are conveyed to several local authorities, shall be extended in several directions. The northern line to Wollongong will be extended to Bulli; the southern line to Nowra is to be continued to Jervis Bay; an interconnecting line will be constructed from Kiama to Moss Vale, *via* Jamberoo and Robertson, and spur lines from Moss Vale to Bundanoon, and from the Avon dam to Picton. Provision is to be made also for transmission lines to interconnect the system with other distribution systems. It is estimated that the proposed works will cost about £800,000.

TASMANIA.—The same journal reports that unprecedented floods occurred during the first week of April over almost the whole of Tasmania, causing considerable damage. The electric supply to Launceston suffered a serious interruption, the City Council's hydro-electric power station on the South Esk River at Cataract Gorge being swept away by flood waters. The station contained a turbine driving a 1,000-kVA alternator, and four 450-h.p. turbines driving 400-kVA alternators. Fortunately this was not the principal source of the city's supply, for a large quantity of energy is purchased in bulk from the State hydro-electric department, transmitted from Waddamana power station at the Great Lake. Owing to the floods, however, the bulk supply also was interrupted, but was speedily restored, and was able to meet the full demand.

Barnstaple.—ELECTRICITY SUPPLY.—At the request of the Instow Parish Council, the Rural District Council has instructed the Bideford and District Electric Supply Co. to proceed at once with the provision of a supply of electricity for the parish. Underground cables are to be used along the front, and overhead lines in other thoroughfares.

Batley.—YEAR'S WORKING.—It was reported to the Town Council, on June 6th, that the Electricity Department had had a successful year and, despite reductions in the charges for lighting and power, there was a gross profit of £11,026, as compared with £13,389 in the previous year. The chief reason for the reduced profit was that over £4,000 expended in respect of capital works had been charged to revenue account. The net profit was £4,576.

Bingley.—YEAR'S WORKING.—A net loss of £2,106 on the working of the electricity department for the past year was reported to the Urban District Council on May 27th. The loss was attributed largely to reduced sale of electrical energy for power purposes, in consequence of the depressed local industrial conditions. There was also a reduction of income from traction supplies due to curtailment of tramway services. The gross profit of the year amounted to £5,669. There was an increase of £1,800 in loan charges, due chiefly to a capital expenditure of £14,000 during the year in extending supplies to outer districts. As the supply becomes more established in these districts this burden will be reduced. The total number of consumers (1,882) showed an increase of 284 on the previous year, and the total energy sold an increase of 50,200 kWh. A reduction in the charge for electricity was introduced during the year.

Birkenhead.—LOAN.—The Corporation Electricity Committee is seeking sanction to a loan of £25,000 for mains and services.

PURCHASE OF PLANT.—The Electricity Committee has agreed to accept the offer of the Wallasey Electricity Committee to pay £16,500 for the purchase of the electricity plant at Moreton. The Committee has also agreed to the offer of the Wallasey Electricity Committee to reduce the kW charge for the bulk supply of electricity to the city from 18s. 9d. to 17s. per quarter.

Blackburn.—YEAR'S WORKING.—The report of the Electricity Department on the working of the electricity undertaking for the year ended March 31st last shows a gross profit of £135,848. After deducting £69,086 for interest, &c., £61,569 debt repayment, and £12,181, capital expenditure charged to revenue, there is a deficiency on the year of £7,888. The deficiency carried forward from a year ago was £77,289, giving a total of £85,177, of which £30,000 was charged to rates. With the provision in this year's estimates for £20,000, there is £35,177 to carry forward. A 10 per cent. increase in charges yielded £16,439. Additional borrowing powers of £97,574 were granted during the year, making a total of £1,906,267. The capital expenditure against this was £1,838,646. There is £66,144 in the sinking fund, the net debt amounting to £1,295,989. Electricity sold increased by 1¼ million kWh, excluding the bulk supply to Preston, the total energy sold for all purposes being 27,868,989 kWh, an increase of 3,397,425, or 14 per cent.

Brazil.—HYDRO-ELECTRICAL DEVELOPMENT.—Good progress is being made with the work on the extensive Serra do Cubatao hydro-electric development scheme of the San Paulo Tramway, Light and Power Co., Ltd. During 1924 and 1925 a prolonged drought reduced the volume of the Tiete and Sorocaba rivers to below normal, and as an emergency measure the Rasgao plant (32,000 h.p.) on the Tiete river, about 25 miles below San Paulo, was constructed. The Cubatao hydro-electric plant is situated near the San Paulo-Santos road, and at present has a capacity of 96,000 h.p. Arrangements, however, are being made to install another pipe line and place an additional unit of 60,000 h.p. into service. The four principal generating plants of the company—Sorocaba, Rasgao, Parnahyba and Cubatao—are so interconnected that any one of them may be shut down and the entire system supplied with power from those remaining in operation. Eventually this system will be connected with the generating plants supplying the Rio de Janeiro district of Brazil.

Burnley.—MAINS EXTENSIONS.—The Electricity Committee has approved an extension of an existing e.h.p. main from Holmby Street sub-station to the cold stores, at a cost of £4,602.

Continental.—SWEDEN.—It is reported that the construction of the power plant on the Indal River to exploit the Kraangede rapids is to begin in 1932 and is to be completed in 1936. The total cost of the undertaking is estimated at Kr. 14,000,000. The plant will have an initial capacity of 50,000 kW, but it is possible that it will be extended to 150,000 kW.—*Reuter's Trade Service* (Stockholm).

RUSSIA.—According to the *Elektritchestvo*, the Soviet Central Electrotechnical Board has approved the construction of a power station in the Briansk district, the boilers of which will be adapted for peat firing. In connection with the new plant a 110-kV ring distribution system is to be installed. The Board has also approved plans for the extension of the power station at Sebastopol in order to supply electricity in the Krim Peninsula. The scheme includes the erection of 60-kV transmission lines between Sebastopol and Sympheropol, and between Sebastopol and Ilta.

SWITZERLAND.—Nine large hydro-electric power stations are at present in course of construction at Ruchlig-Arrau, Ctampsee, Dixance, Handeck, Ryborg-Schworstadt, Orsieres, Sembrancher, Monte Piottino, and an extension at Laufenburg, which will have a total capacity of 478,500 h.p.

Dover.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. R. C. Harpur) for the year ended March 31st last show a total revenue of £50,502, as compared with £51,755 in 1927-28, and working expenses of £24,599, as against £23,760, leaving a gross profit of £25,903 (£27,995), to which was added a balance from the previous year of £2,925, and interest, £64, making £28,892. Capital charges, &c., absorbed £21,936, and there was a net surplus of £6,956, as compared with £8,960 in the preceding year. The sales of electricity increased from 2,969,320 to 3,157,516 kWh. The average price obtained per kWh fell from 4.18d. to 3.84d.

LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £3,000 for services.

Eastbourne.—OVERHEAD LINES.—At a meeting of the Corporation Electricity Committee, held recently, the plan prepared by the consulting engineer showing the route of the overhead transmission lines to the parishes of Eastdean and Westdean was submitted and approved. It was noted that the line between Huggett's lane, Willingdon, and the Friston waterworks would operate at 33,000 V, that the Central Electricity Board would pay for this line or a portion thereof, and that the Corporation would pay the capital charges on it until it was taken over by the Board and continued to Newhaven. At Friston the Central Board is to erect a transformer station, and at this point it is proposed to carry a line through Friston to Eastdean at a pressure of 11,000 V, which will be the property of the Corporation.

Epsom.—LOANS.—The Urban District Council has applied for sanction to loans of £1,000 for assisted wiring, and £1,200 for a new switchboard.

Exeter.—ELECTRICITY SUPPLY PROGRESS.—The annual report of the city electrical engineer, issued recently, shows that the number of consumers at the end of the year was 7,175, an increase of 757. Electricity sold totalled 5,975,699 kWh, an increase of 934,677 kWh. The total length of mains is now approximately 140 miles. Since the completion of the recent alterations the cost of production has been considerably reduced, and when the additional new plant is in operation will be reduced still further. The Electricity Committee has resolved to apply for sanction to loans totalling £20,000 principally for mains, sub-stations and equipment to serve the east of the city, while a further loan of £2,000 is being applied for in connection with mains to serve the southern area.

Gainsborough.—GENERATING STATION.—The Urban District Council, on June 3rd, rejected a proposal from the Yorkshire Electric Power Co. to take over the Council's generating station. The company supplies the town with electricity in bulk to supplement that from the local station, which has recently been acquired by the Council.

Hull.—HIRE-PURCHASE SCHEME.—At a meeting of the Corporation Electricity Committee held recently, the engineer reported that he wished to introduce a scheme of hire and

hire-purchase of cookers and other domestic apparatus for consumers in the area. The cooker scheme would include free maintenance and repair by the Department during the period of hire, and also the necessary wiring and installation. The majority of the wiring installations would be carried out to the department's specification at an agreed rate by approved contractors, and the repair and maintenance by the department's own staff. In view of the uncertainty of the capital required to finance the scheme, the engineer was of the opinion that as a commencement £25,000 of the existing reserve fund should be allocated for this purpose. He was authorised to proceed with the scheme.

NEW COOLING TOWER.—At a recent meeting of the Corporation Electricity Committee, the engineer reported that it would be necessary in the near future to augment the cooling tower capacity at Sculcoates power station, and it was decided that an additional cooling tower be installed. This will require further pumping plant and a certain amount of piping to connect up the cooling tower. The total cost of the scheme is estimated at £22,000.

STREET LIGHTING.—The Health Committee has adopted a scheme for electric lighting of the roads at the infectious diseases hospital, at a cost of £1,000.

Irish Free State.—DUNGARVAN.—The Electricity Supply Board has made an offer of £5,000 for the purchase of the Dungarvan electricity undertaking. A special meeting of the shareholders was held, and the offer read and submitted for consideration. The amount offered would give the shareholders 10s. 4d. for every £1 of their holding, and in view that 10 per cent. is being paid as dividend, the offer was considered inadequate. The meeting appointed a deputation to wait upon the Supply Board and endeavour to secure terms that would not entail a loss to the shareholders.

Isle of Wight.—SPECIAL ORDER.—The County Council has reported that at a further conference of the representatives of the Island local authorities held recently, it was resolved to recommend the local authorities to support the application by the Isle of Wight Electric Light and Power Co., Ltd., for a Special Order to cover that portion of the Island where existing local Orders now apply, and that each of the local authorities should appoint two delegates with powers to settle the terms of agreement with the company. Under the company's proposals ten existing Orders would be replaced by one Order for the whole island. The system of supply would be changed from d.c. to a.c., and the price throughout the island would be:—Lighting: 8d. per kWh. Power, 3d. to 1½ per kWh on a modified sliding scale. Heating: 2d. per kWh, subject to a sliding scale on the basis of 8 per cent. interest on the capital. The charge for minimum consumption would be based on half-yearly periods (one summer and one winter period) instead of quarterly as at present.

Leeds.—PURCHASE OF PLANT.—The City Council has received a proposal to buy, at a cost of £44,500, all the cables, mains, fittings, buildings, machinery, and apparatus of the Yorkshire Electric Power Co. in the Hunslet, Tadcaster and Wharfedale rural districts, which were added to the city by local Act of Parliament in 1927. A similar suggestion has been made in respect of the powers of the Electrical Distribution of Yorkshire, Ltd., in the Eccup district for the sum of £500.

Leek.—LOANS.—The Urban District Council has applied for sanction to loans of £2,500 for cables, &c., in connection with a supply of electricity to Longsdon, and £2,490 for laying a new feeder cable.

Leyton.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £24,590 in connection with the change-over scheme from d.c. to a.c.

Liverpool.—MAINS EXTENSIONS.—The Extensions Sub-Committee of the Electric Power and Lighting Committee is to undertake a number of extensions to h.p. mains in several of the outside districts. The work in Booker's Avenue and Greenhill Road will involve new h.p. mains estimated to cost £2,877, l.p. mains £1,136, sub-station equipment £2,000, and an h.p. cubicle in the Holmefield Road sub-station £200. In the Borrowdale Road and Greenbank Drive area, h.p. mains will cost £1,980, l.p. mains £7,660, and the equipment of a sub-station £2,000. It is intended to change over the installations and apparatus on consumers' premises to a.c. at an approximate cost of £1,416.

Northern Ireland.—ELECTRICITY SUPPLY PROGRESS.—Speaking in the Northern Parliament on June 5th, the Minister of Commerce stated that the development of electricity services was making steady progress. At the present time no less than one-third of the population had a public supply of electricity available. It was hoped that within a few years' time the majority of the factories might be able to obtain cheap power from e.h.p. transmission lines in their vicinity. Such a transmission line now ran between Belfast and Lisburn, but it was only the first link in the chain. Before the end of the year another link would run from Holywood to Bangor, and would be extended to Newtownards. He looked forward in the near future to extensions in the Lagan Valley, and to the linking up of the principal towns in County Antrim.

OMAGH (CO. TYRONE).—At the meeting of the Urban District Council held recently, the Council adopted a recommendation from the Finance Committee regarding the proposed electric lighting scheme for the town. The Committee recommended that the lighting area be within a radius of one and a-half miles from the gasworks; that the mains be carried underground from the power station to Market Street; that overhead lines be erected through all the principal streets, and that public lamps be provided. It was decided to confirm the appointment of Mr. Spalding as engineer in connection with the scheme, and to make application for a loan for the work.

Peterborough.—EXTENSIONS TO PLANT.—The Town Council has decided to place before the Central Electricity Board particulars relating to the present generating plant and boiler plant, and the suggestions of the manager of the electricity undertaking for extensions estimated to cost £65,000.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

DONCASTER.—For domestic users: From 12½ per cent. to 10 per cent. on ratable value (minimum charge 35s. per year), plus ¾d. per kWh. Power supply to tramway undertaking: 10 per cent. discount on present charges (1d. per kWh). The reduction operates from April 1st last.

CAERNARVON.—*National Electric Construction Co.*—Lighting: From 7d. to 6d. per kWh.

PENMAENMAWR.—Lighting: From 8d. to 7d. per kWh. Heating and cooking: To 1d. per kWh.

Salford.—LOAN.—The Corporation Electricity Committee is seeking sanction to a loan of £5,230 for the erection and equipment of sub-stations.

Sefton.—ELECTRICITY SUPPLY.—It was reported, at a meeting of the Town Council held recently, that, in connection with the proposed supply of electricity by the Liverpool Corporation, the Corporation is now awaiting an Order. The Council, after being informed that local landowners desired to supply farms and cottages in the area for the winter, decided to approach the Liverpool Corporation to point out that there was nothing to prevent it from proceeding with its Fringe Order to supply Ince Blundell.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at an estimated cost of £24,891.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order for the Worksop Urban District Council authorising it to extend its area of electricity supply by the addition of the parish of Whitwell. Application has also been made by the York Corporation for an amendment of the York Electricity (Extension) Special Order so as to provide that the area of supply to be described in the proposed Order shall include the township of Warthill and part of the township of Boroughbridge.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Trent Valley and High Peak Electricity Co., Ltd., to supply electricity in the rural district of Hayfield and part of the rural district of Glossop Dale.

Stalybridge.—LOAN.—The Stalybridge, Hyde, Mossley and Dukinfield Electricity Board is to seek sanction to a loan of £25,000 for new electrical machinery.

Stone.—ASSISTED WIRING SCHEME.—The Urban District Council has adopted an assisted wiring scheme, and has also decided to install slot meters when required.

Walthamstow.—PURCHASE OF LAND.—Application has been made to the Electricity Commissioners by the Urban District Council for consent to extend the site of the Council's generating station.

Wrexham.—LOAN.—The Town Council has applied for sanction to a loan of £800 for installing and equipping a sub-station at the Abbot leather works and a transformer kiosk at Old Acton smithy.

York.—RECTIFYING PLANT.—The Corporation Electricity Committee has recommended the installation of rectifying plant at the Groves sub-station, at an estimated cost of £1,460, with a view to further supply in the Groves district. The alternative would be a change-over to a.c. at an estimated cost of £4,000.

Tramway and Railway Notes.

Australia.—BRISBANE (Q.).—We have received from Mr. G. R. Steer, general manager of the city tramway undertaking, a copy of his report and the statement of accounts for the year ended December 31st last. The total revenue amounted to £810,954, as compared with £814,312 for the preceding year. Working expenses were £594,126, as against £613,285, and there was a special expenditure of £13,586 on various changes of premises, leaving a gross profit of £203,243 (£201,027). After providing for interest on loans, depreciation, amortisation and sinking fund, there was a net surplus of £6,118, as compared with a surplus of £17,313 in the previous year. The number of car miles run increased from 6,535,833 to 6,570,228, but the number of passengers carried fell from 78,057,620 to 77,703,264; this is attributed to the great in-

crease in the number of private motor-cars, the temporary depression in trade and operation of privately-owned motor-'buses. The revenue per car mile dropped from 29.02d. to 28.88d.

Barrow.—YEAR'S WORKING.—At a recent meeting of the Town Council the report on the working of the tramway undertaking for the year ending March 31st was submitted. The total income was £34,066, as compared with £36,333 in 1927-28. Working expenses amounted to £28,627, as against £29,602, and after meeting other charges there was a net loss of £9,672, as compared with a loss of £8,541 in the preceding year. The total deficiency at the end of the year was £19,588, of which £8,645 has been included in the general rate for the current year, leaving a deficit of £10,943 to be carried forward. The car-miles run during the year decreased by 12,405.

Continental.—ITALY.—The work of electrification having been completed, electric trains are now running between Rome and Sulmona, and between Alessandria and Ovada.

Exeter.—CONSULTANT'S REPORT.—Mr. A. R. Fearnley, of Sheffield, the expert called in by the Corporation Tramways Committee to advise as to problems of extension and the future of the tramway undertaking generally, has submitted his report, in which he has recommended that no further expenditure be made upon the system except such as is sufficient to keep it in immediate operation. He states that the tramway is efficiently managed and operated, but points out that a considerable amount of track renewal will be required during the next few years, involving an estimated outlay of over £12,000, and also that a considerable amount of rail grinding will be necessary, corrugation having reached a serious stage. Having in mind the existing conditions in the centre of the city, which render tramway operation unsuitable, also the amount of capital expenditure involved (£20,750) in the proposed extension to Whipton, he has recommended that, instead of constructing the proposed extension, the Corporation should at once obtain three double-deck top-covered motor-omnibuses at an estimated cost of £1,798 per 'bus. He has advised the Committee against the adoption of the railless-car system.

Leeds.—TRAMWAY SCHEME DEFERRED.—The Corporation Tramways Committee has deferred consideration of the question of obtaining Parliamentary powers for the running of a tramway service along Easterly Road until the Corporation is promoting a Bill in Parliament.

Liverpool.—YEAR'S WORKING.—It is reported that the working of the Corporation tramway undertaking for the year ended March 31st last resulted in a net surplus of £154,000, of which £75,000 has been contributed to the borough fund.

London.—DERAILMENT.—A considerable delay was caused in the evening of June 6th by the derailment of a train on the Tube Railway at Kennington. The train was almost full of passengers, but no one was hurt. The cause of the derailment has not yet been discovered.

Manchester.—YEAR'S WORKING.—We have received from Mr. R. S. Pilcher, general manager of the Corporation tramway undertaking, a copy of the report of the Tramways Committee, together with the statement of accounts for the year ended March 31st last. The revenue accounts show a total income of £1,814,705, as compared with £1,856,592 in the preceding year, a decrease of £39,977. The report states, however, that of this decrease over £20,000 was lost in the latter part of the year, during which a spell of very severe weather was experienced. Working expenses increased from £1,476,480 to £1,487,487, resulting in a smaller gross profit at £327,218, as against £380,112. To the gross profit was added a balance from the motor-omnibus system, interest, and an unemployment grant, making a total of £358,211 available, against which was charged loan and bank interest, rent of leased lines, &c., leaving a balance of £193,798. This was transferred to appropriation account with a contribution of £14,693 from the 'bus account to sinking fund, and disposed of as follows: Sinking fund and loan instalments, £115,675; street improvements, £12,407; renewals fund (net surplus), £80,408. The previous year's working resulted in a surplus of £146,138. The capital expenditure amounted to £277,094, the chief items being £57,737 for permanent-way, £85,676 for buildings and fittings at Hyde Road depôt, £39,053 for rolling stock, and £41,056 for motor-omnibuses. The total now spent on the undertaking stands at £4,443,696. The number of passengers carried decreased from 328,013,199 to 322,815,254, but the car miles run increased from 24,182,506 to 24,456,250. The average total revenue per car mile fell from 18.426d. to 17.808d., and the total consumption of electrical energy increased from 46,966,311 to 48,818,166 kWh. Complete overhead equipment was erected in Heywood, and the following lines were constructed: Market Place, Middleton; Oldham Road and Mills Hill to Chadderton boundary; Rochdale Road, Middleton, to Castleton boundary; Manchester Road, Heywood (in progress). During the year 27 single-truck cars were converted into vestibule double-truck cars, and the number of cars in stock at the end of the year was 953.

Sheffield.—NEW TRAMCARS.—The Corporation Tramways Committee has authorised the general manager to proceed with the construction of ten double deck tramcars, to be built in the tramway workshops.

Southern Railway.—ELECTRIFICATION.—The expenditure of £597,000 has been sanctioned by the Southern Railway for three important extensions of its suburban electrified system. These additions, which will increase the number of track miles electrified to 800, will, it is hoped, be completed in time for the summer service of 1930. The first portion of 27½ miles, between Hounslow and Whitton Junction and Windsor, involves the lengthening of station platforms at Feltham, Staines and Wraysbury, and the erection of sub-station buildings at Ashford and Datchet. The second section of the proposed scheme is between Dartford and Gravesend, a distance of 14 miles, and will necessitate the lengthening of platforms at Greenhithe (including the rebuilding of the station), Northfleet and Gravesend Central. A sub-station will be erected at Northfleet, while Stone Crossing Halt and Swanscombe Halt are to be reconstructed. In connection with the third section, of eight miles, between Wimbledon and West Croydon, the principal works are the construction of a halt at Waddon Marsh, between Beddington Lane Halt and West Croydon, and the linking up of certain sidings to form an independent goods line between West Croydon and Beddington Lane. A twenty-minute service of trains will be run during business periods, and a thirty-minute service at other times. The popularity of the electrified system on suburban routes is revealed by the fact that last year 6,500,000 more passengers were carried than in 1927, and in that year the increase was 11,500,000 over 1926.

Telegraph and Telephone Notes.

Belgium.—TELEGRAPH CABLE SYSTEM.—It is stated that the new cable connections established by Belgium last year with neighbouring countries, and for connection with England, have proved to be inadequate owing to the growth of the traffic. Under the circumstances proposals are now under consideration for the execution of further extensions at an estimated outlay of 200,000,000 fcs.

International Telephony.—ENGLAND-ITALY.—The British Post Office announced on June 8th that a "through" telephone circuit between London and Milan had been brought into operation. The new circuit will permit of a more rapid service between this country and Italy.

South America.—RADIO CONCESSIONS.—Further extension of the wireless rights of the International Telephone and Telegraph Corporation, of New York, is evident from the announcement that the South American Republic of Colombia has granted to All-America Cables, Incorporated, an affiliated concern, a concession for the construction of a wireless station at Bogota (the capital of Colombia), and two coastal stations, one on the Atlantic and the other on the Pacific. Peru also is reported to have granted rights to the same company.—*Reuter's* (New York).

The Telephone Service.—GROWTH.—Official statistics published in the *Telegraph and Telephone Journal* show that the total number of telephones in operation at the end of the financial year (March 31st) was 1,754,641, a total increase of 123,450, or 7.6 per cent. The various increases are shown in the following table:—

	Total, 1928.	Total 1929.	Increase.	Increase %.
London	578,322	626,714	48,392	8.4
England and Wales (excluding London)	883,435	948,934	65,499	7.4
Scotland	148,934	157,169	8,235	5.5
Northern Ireland ...	20,500	21,824	1,324	6.5
	1,631,191	1,754,641	123,450	7.6

The number of public call offices (including kiosks) working at March 31st last was 25,864, of which 5,599 were connected with London exchanges, and 20,265 with provincial exchanges; the net addition for the year was 1,810, or 7.5 per cent. Of the net increase of 1,810 call offices, 1,591, or 88 per cent., were kiosk call offices. On March 31st last the kiosks connected with London exchanges numbered 1,273 and those with provincial exchanges 5,005, a total of 6,278 kiosks, practically a quarter of the call offices now working. During the year 126 new exchanges were opened under the rural development scheme of 1922, bringing the total number of exchanges open under that scheme up to 1,267, in addition to which a further 79 were in course of construction at the end of March. The total number of exchanges working at March 31st, 1929, was 4,476.

CABLE FIRE.—A fire, similar to others which broke out within a few days of each other in September, 1928, occurred in a tunnel under the Thames Embankment, London, on June 6th. The tunnel accommodates electricity cables, gas and hydraulic mains, and telephone and telegraph cables. Telephone and telegraph services were interrupted, and the British Broadcasting Corporation's land lines were placed out of commission.

TOLL EXCHANGE.—With a view to speeding up service, the Postmaster-General announces that a number of additions have been made to the towns already served by the Toll exchange, instead of "Trunks."

MANX CABLE.—The cable ship *Faraday* finished laying a telephone cable between Norbreck, near Blackpool, and Port Greenough, Isle of Man, during the night of June 5th.

The Telegraph Service.—TIME EXTENSION.—The Post Office authorities announce that from July 1st the hours during which telegrams are accepted and delivered will be extended to 9 p.m. at all head offices which now observe an earlier closing time, and also at a certain number of sub-offices in the country.

Radio Notes.

Australia.—PROGRAMME TENDERS.—The Federal Government has accepted the tender of Union Theatres, Ltd., Fullers Theatres, Ltd., and Messrs. Frank Albert and Son for the supply of programmes for a national broadcasting service on the basis of a payment to the tenderers of 12s. from each listener's licence fee.

France.—BROADCASTING BILL.—The broadasting Bill of M. Germain-Martin, Parliamentary Under-Secretary to the Post Office, has been deposited before the Chamber of Deputies, and referred to the Commission of Public Works. The principal terms of the Bill are, according to *World-Radio*, as follows:—No transmitting station can be erected, or worked, except by the State, or concessionaires under the control of the State. No concession will be given for a period of more than twenty years. Any transmitting station can be suspended by a Government decree.

A Broadcasting Committee will be formed which will meet every two months and will study all questions; it will consist of forty-three members appointed by the Prime Minister, and will include a representative of each Ministry interested in broadcasting, and representatives of intellectual, artistic, scientific, economic, and social groups, together with representatives of the Press and of listeners.

A National Office of French Broadcasting will be formed to look after development, the working of the State transmitting stations, and the national laboratory of radio-electricity, under the authority of the Prime Minister, administered by a Board consisting of fifteen members. The Budget will be provided from three sources: (1) by an annual tax of Frs. 20 on each crystal set and Frs. 50 on each valve set; (2) by a tax of 4 per cent. on the selling price of all valves; (3) by grants, legacies, donations and sundry receipts.

All wireless sets must be declared within a month of the Bill becoming law, and all purchases of sets must be declared by the buyer within eight days of the purchase. Dealers also will have to make declarations of sets sold by them. Fines of from Frs. 50 to 200, plus five times the amount of tax evaded, will be inflicted in case of non-declaration. The concessionaires or directors of transmitting stations must be of French nationality. Advertising matter must not occupy more than one-tenth of the programme of each station.

The Cabinet will fix by a decree the number and situations of the State and private transmitting stations, which are conceived of as falling into three classes, of very high power, regional power, and local-service power, respectively. The last-named will depend largely on private initiative for their support. There will also be a powerful station on a short-wave, which will broadcast several times a day for the benefit of the French colonies. The Bill is meeting with a good reception.

The Prague Plan.—NEW WAVE-LENGTHS.—Of special significance is the table of new wave-lengths presented by the B.B.C. in a description by Capt. P. P. Eckersley of the Plan de Prague, for the table in question contains not only the reallocation of wave-lengths as from June 30th when the Prague plan takes effect, but also the provisional reallocation of wave-lengths on the opening of London's regional transmitter at Brookman's Park for a second programme some few months hence.

Capt. Eckersley explains in the article, which accompanies the table in the June 7th issue of the *Radio Times*, that on the suggestion of the Czecho-Slovakian Government a conference of representatives of the European Governments was held in Prague last April to discuss wave-lengths with the work of the International Union of Broadcasting as a basis. Every interested Government was represented at Prague and the official delegations were composed of Post Office officials. The conference finally ratified the Plan de Prague, essentially a modification of the Brussels plan, which involves sacrifice for Britain as it does for Germany and Sweden, countries favourably placed because of their early start in the broadcasting field. However, complete agreement has at last been reached with the seal of officialdom upon the labours of the experts and, except in minor details, it is unlikely that there will be any changes for some years to come; far greater agreement on wave-length allocation has been achieved in Europe than in North America. Britain has, as always, ten exclusive waves; the shorter waves, unfortunately, have to be used, and it is better to have a shorter wave unheterodyned than an apparently much better and longer wave jammed. It is hoped to open the London station for double-wave working towards the end of this year. There will be further changes, not in wave-lengths, but rather in the wave-lengths used by the different stations, as the regional scheme develops and new stations are opened and old ones are superseded. At present there will be no changes in the principal wave-lengths of the Daventry (5XX) and (5GB), Manchester, Glasgow, London, and Cardiff stations.

The Union Internationale.—LAUSANNE SESSION.—The annual general assembly of the Union Internationale de Radiophonie which has just concluded its sessions at Lausanne, elected Vice-Admiral C. D. Carpendale, C.B., controller of the British Broadcasting Corporation, to be its president for the fifth year in succession. This assembly was notable, among other things, for the fact that for the first time the French Government took up active membership, which, in conjunction with other adhesions actual or pending, brings practically all European broadcasting within the Union. As a result of the recommendation of a conference of all European administrations concerned with wireless, held at Prague recently, the Union is now the recognised centre for all broadcasting questions of an international character. The first step taken at Lausanne in implementing this decision was to adapt the former statutes to the new conditions and to provide for the management and finance of the wave-length checking centre at Brussels, which has been in existence for some time, but has now been officially made the master-regulator for Europe.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—July 15th. State Electricity Commission of Victoria. Two 750-kVA transformers and spares. (B.X. 5325.)*

July 23rd. Posts and Telegraphs Department. Telegraph instruments. (B.X. 5323.)*

June 25th. Underground and aerial telephone cables. (B.X. 5346.)*

Belfast.—June 17th. Electricity Department. H.p. combined cubicle and truck type switchgear and transformer kiosks, one 1,000-kW rotary convertor, one 500-kW rotary convertor, d.c. switchgear, h.p. armourclad switchgear, and h.p. truck-type switchgear for sub-stations. (May 31st.)

Denmark.—COPENHAGEN.—June 21st. Municipal Council. Switchgear for the "Faelledveg" sub-station extensions. (B.X. 5367.)*

East Grinstead.—June 17th. Electricity Department. Supply, laying and jointing of a system of l.p. cables, complete and ready for use. (May 31st.)

Edinburgh.—June 17th. Education Committee. Electrical installations at Colinton, Davidson's Mains, Gilmerton, Granton, Juniper Green, Willowbrae, and Milton House Schools. Specifications, &c., from Executive Officer, Education Offices, Castle Terrace, Edinburgh.

Egypt.—CAIRO.—July 15th. Ministry of Interior. One 250-kVA Diesel engine-driven a.c. generating set, with switch and control gear. (B.X. 5331.)*

August 13th. Supply of an electric power station with underground and overhead network for the town of Maghagha. (B.X. 5318.)*

Holywood.—July 2nd. Urban District Council. Laying and erection of l.p. underground and overhead mains and h.p. cable, erection of l.p. switchboard, h.p. armour-clad and truck-type switchgear, and 3-phase transformers. (See this issue.)

Hull.—June 20th. Electricity Department. Supply of stores for 12 months from July 1st, 1929. (June 7th.)

India.—SIMLA.—July 8th. Indian Stores Department. 30-kW oil engine-driven generating set for the Military Engineering Services, St. Thomas Mount, Madras. (B.X. 5364.)*

Leeds.—June 17th. Education Committee. Electrical wiring of schools during midsummer vacation. Particulars from Education Offices (architect's section), Calverley Street, Leeds.

London.—CENTRAL ELECTRICITY BOARD.—June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (May 17th.)

July 22nd. Supply, delivery and erection of central indicators and telephones for the Central Scotland Electricity Scheme, 1927. (June 7th.)

LONDON COUNTY COUNCIL.—July 8th. 150 complete bodies for tramcars, 150 sets of swing bolster bogie trucks, 150 electrical equipments for tramcars, &c., and 150 magnetic track and wheel brake equipments. (June 7th.)

Newport (Mon.).—June 22nd. Electricity Department. One 1,250-kW motor convertor and switchgear. (June 7th.)

New Zealand.—WELLINGTON.—August 7th. Posts and Telegraph Department. Enamelled and silk-covered resistance wire. (B.X. 5322.)

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

September 4th. Government Railways. Motor generator. (B.X. 5308.)*

AUCKLAND.—August 19th. Auckland Electric Power Board. Single-phase transformers. (B.X. 5324.)*

Nottingham.—June 28th. Electricity Department. Supply of general stores for the electricity undertaking for 12 months from July 1st, 1929. (June 7th.)

South Africa.—PRETORIA.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

August 1st. Telephone cable. (B.X. 5345.)*

PIETERSBURG, TRANSVAAL.—August 13th. Municipal Council. Steam-raising plant, engine alternators, and switchgear. (A.X. 7983.)* H. and l.p. cable, lamps and sundries. (B.X. 5312.)*

JOHANNESBURG.—June 27th. South African Railways and Harbours. 2,200- and 600-V cables and accessories. (B.X. 5343.)*

June 20th. City Council. Supply and delivery of h.p. and l.p. cables. (B.X. 5342.)

Stafford.—July 2nd. Staffordshire Education Committee. Installation of electric light at Kingswinford Brockmoor Council school. (June 7th.)

Sunderland.—July 8th. Electricity Department. Paper-insulated, lead-sheathed cable, rubber-insulated wire, meters, gasfilled and vacuum lamps. (June 7th.)

Turkey.—CONSTANTINOPLE.—July 4th. Administration Générale des Chemins de fer et Ports d'Etat. Wires, cables and general lighting accessories. (B.X. 5368.)*

Uruguay.—PORT AUTHORITIES.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

West Ham.—June 17th. Education Committee. Installation of electric lighting at Fyfield open-air school extension, and installation of water-heating apparatus at Balaam Street School, Plaistow. (May 24th.)

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Three 225,000-lb. boilers with economisers, air heaters, fans, &c. (June 7th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Gas Committee. Accepted :—
Trident electric scaling machine.—Liverpool Patents Co., Ltd.

Electricity Committee. Accepted :—
Cable (£1,276).—Macintosh Cable Co., Ltd.; and (£1,982), Hackbridge Cable Co., Ltd.
Overhead lines (£4,484).—W. T. Henley's Telegraph Works Co., Ltd.

Colchester.—Town Council. Accepted :—
E.h.p. generator panel and two l.p. a.c. feeder panels, earthing cubicle, and cable connections (£1,650).—Electrical Construction Co., Ltd.
E.h.p. cable (£5,883), supply and erection of overhead l.p. distribution lines, and poles in the Wivenhoe Urban District (£2,494), and e.h.p. and l.p. cable (£13,108).—W. T. Henley's Telegraph Works Co., Ltd.
Three 11,000- and 6,600-volt kiosks (£1,275).—Crompton Parkinson, Ltd.

Derby.—Town Council. Accepted :—
Pipe work for the new turbo-alternator and two additional boilers (£5,073).—Aiton & Co., Ltd.

Hull.—Telephones Committee. Recommended :—
Cable (£1,295).—W. F. Dennis & Co.
Mental Hospital Committee. Accepted :—
Wiring pavilion at Tilworth Grange (£118).—Clarke and Graham.
Tramways Committee. Accepted :—
Standard electric lamps.—Clarke & Graham.
'Bus electric lamps.—General Electric Co., Ltd.

Leeds.—Electricity Committee. Accepted :—
Cables.—(£2,450), W. T. Henley's Telegraph Works Co., Ltd.; (£3,084), Enfield Cable Works, Ltd.; (£5,225), Macintosh Cable Co., Ltd.; (£906), Hackbridge Cable Co., Ltd.; and (£2,743), Greenwich Cable Works, Ltd.
Works transformers (£2,170).—Hackbridge Electric Construction Co., Ltd.
Tramways Committee. Accepted :—
Two rail grinders (£1,043).—Equipment & Engineering Co., Ltd.
200 yards guard rail (£270).—Edgar Allen & Co., Ltd.
1,150 yd. conduits (£304).—Leeds Fireclay Co., Ltd.

Liverpool.—City Council. Accepted :—
Supply of two h.p. metal-clad switch units for the Waterloo sub-station (£741).—Ferguson, Pailin, Ltd.

London. — CAMBERWELL. — Baths Committee. Recommended :—
Additional electric lighting at Wells Street baths (£119).—W. M. Williamson.

Manchester.—Education Committee. Accepted :—
Electrical installations.—At Burnage School, Sudlow and Co.; and at Higher Ormond Street School, Seddon and Sons.
Electricity Committee. Accepted :—
Repairs to Dickinson Street battery.—Tudor Accumulator Co., Ltd.
Three 1,000-kVA transformers.—British Thomson-Houston Co., Ltd.
One 11,500-kVA auto-transformer.—Hackbridge Electric Construction Co., Ltd.
33,000-V feeder protective gear.—A. Reyrolle & Co., Ltd.
H.p. steam pipework at Barton works.—Foster Bros., Ltd.
Tramways Committee. Accepted :—
Cadmium copper trolley wire.—R. Johnson & Nephew, Ltd.
Tramway rail bonds.—British Insulated Cables, Ltd.
Mild steel electrodes.—Welding Equipment Co., Equipment & Engineering Co., Ltd.; and Quasi-Arc Co., Ltd.
Cleansing Committee. Accepted :—
Electric cable for Water Street depôt.—R. H. Clampnett and Co.

Oldham.—Electricity Committee. Accepted :—
Two transformers.—Ferranti, Ltd.

Reading.—Town Council. Accepted :—
Electrical blowing apparatus for the organ in the large Town Hall (£267).—H. Willis & Son, Ltd.
Electrical wiring in connection with above.—Reading Electric Supply Co., Ltd.

Rotherham.—Electricity Committee. Recommended :—
Two pairs truck type switches (£256 per pair).—A. Reyrolle & Co., Ltd.
Spare armature (£215).—Metropolitan-Vickers Electrical Co., Ltd.
Rectifying plant (£2,375).—Brown, Boveri, Ltd.

Salford.—Tramways and Motor Omnibus Committee.
12,000 electric traction lamps (£437).—Nelson Electric Co., Ltd.
Commutator spares (£364).—Manchester Armature Repair Co., Ltd.
Insulating tapes.—L. Andrew & Co., Ltd., and Hamnett and Andrew.
Gear and pinion wheels (£1,039).—British Hele-Shaw Patent Clutch Co., Ltd.
Axles.—J. Baker & Co. (Rotherham), 1920, Ltd.
Steel tires (£839).—Brown, Bayley's Steel Works, Ltd.
Brake blocks (£720).—National Rail & Tramway Appliance Co., Ltd.

Sheffield.—Electricity Committee. Accepted :—
Two 11,000-V feeder panels (£468).—A. Reyrolle & Co., Ltd.

Torquay.—Electricity Committee. Accepted :—
"Liptak" type of flat furnace arches for two boilers (£1,024).—Stirling Boiler Co., Ltd.
One 2,000-kVA Scott transformer group (£906).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear (£696).—British Thomson-Houston Co., Ltd.
Voltage regulator for Paignton (£1,400).—English Electric Co., Ltd.

Forthcoming Events.

Diesel Engine Users' Association.—Friday, June 14th. Caxton Hall, Westminster, S.W. 6 p.m. "Repairs to Diesel Engine Parts by Electro-deposition." Mr. C. H. Faris.

National Physical Laboratory.—Tuesday, June 18th. Teddington. 3 to 6 p.m. Annual Inspection by General Board.

Electrical Contractors' Association.—June 26th to 28th. Bournemouth. Annual Conference.

Overhead Lines Association.—Friday, July 5th. Summer meeting. Charabanc tour in the Mid-Cheshire Area.

Notes.

Ultra-violet Rays in Rubber Manufacture.

In the course of a leaderette on the above subject in our June 7th issue, page 996, the "Fade-Ometer" (Willmott, Son and Phillips, Ltd.) was referred to as a mercury-vapour lamp in a suitable housing, which is, of course, incorrect, as the instrument consists of a carbon-arc lamp.

The system referred to is applied by the Dunlop Rubber Co. and all its subsidiaries, and also many of the larger tire manufacturers, while artificial sunlight treatment has been provided for its employés by the Dunlop Co., which has opened an ultra-violet-ray clinic at its works for the purpose.

International Communication.

Colonel Sosthenes Behn, president of the International Telephone and Telegraph Co., was heard on June 7th by the American Inter-State Commerce Committee of the Senate which is considering Senator Couzens's Bill, which seeks to establish a general communications commission to control radio and cable telegraph and telephone activities. According to *The Times*, Colonel Behn pleaded that the Government should not only remove the ban imposed by the White Law upon mergers of wire, wireless, and cable communications, but should even encourage them. The policy of the United States Government in preventing such mergers, he declared, was in singular contrast with that of other Governments occupying an equally important position in the field of international communication, and if the United States was to hold its own mergers should be permitted. A decision was reached that the Commerce Committee should investigate the whole field of communications, including transmission of power.

Colonel Behn outlined his plans for a world-wide communication system employing every known method of transmitting information. He gave details of the proposed purchase of the Radio Corporation of America by the I.T.T. and the plans for a new cable between the United States and South America, from New York to Cuba, thence to Venezuela, Brazil, and the Plate, to supplement the three existing west coast cables. He also spoke of the plans for transandean communication between Chile and Peru. Mr. Behn declared, says the *Daily Telegraph*, that before August the transatlantic radio-telephone service between Buenos Aires and Madrid would be opened. Eventually, if the company were allowed to purchase the Radio Corporation, millions of telephones in the United States, Canada, and Cuba would be connected with South America and Europe. The American Telephone and Telegraph Co. was planning a transatlantic telephone to supplement the three radio channels now in use for the radio-telephone service between the United States and Europe. He said it was paying the Radio Corporation 400,000 shares of its stock for the radio facilities of the latter corporation. The estimated value of the facilities is $20,000,000 to $25,000,000, in addition to which he would get the Radio Corporation's contractual relations with foreign companies.

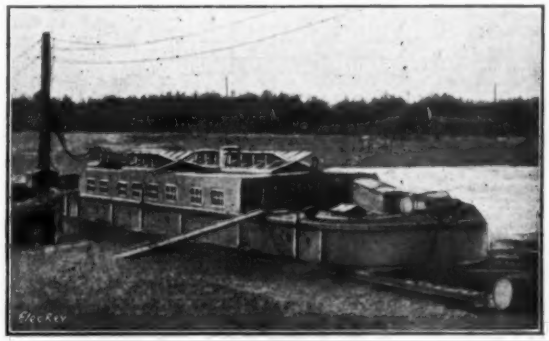
The French newspapers too make reference to Col. Behn's activities: for example, one paper announces that an extremely close agreement has just been concluded between Société Française Radio-Electrique and the Western Electric Co. Under the terms of the agreement the Société Française Radio-Electrique acquires all the patents of the Western Electric Co. concerning wireless telephony, and in future the S.F.R. will only manufacture "American material." Monsieur Chireix will be placed at the head of the department for the manufacture of transmitting apparatus, and Commandant Brenot will be placed at the head of the department for receiving apparatus. At the same time it is declared that the Thomson-Houston and Western Electric Companies and Materiel Telephonique, Ltd., undertake not to concern themselves with wireless telegraphy and telephony in France. The paper comments on the effect the agreement will have on the industry in France, and while some of the reports may be somewhat distorted the following statements are understood to be reliable:—

Regarding international communication, an agreement has been drawn up between the Compagnie Française de Cables Telegraphiques and the Compagnie Radio France for the co-ordination of their technical and commercial resources. This agreement between the two great French transoceanic telegraphic routes will gives the public the benefit of the combined advantages of cables and wireless. The co-operation of the two companies, will, in fact, according to expectation, allow for the sending of messages by either available mode of transmission, thus lessening delays en route and assuring safety in transmission. The French T.S.F. group and P.Q. Cables, on the other hand, have come to an agreement with the American International Telephone and Telegraph group comprising the All America Cable Co., Commercial Cable Co., and Postal Telegraph and Cable Co., for the exploitation of submarine cables and wireless stations in the Antilles, and also a co-operative agreement for the collection and distribution of telegrams to the United States. This agreement should come into force on April 1st next.

Regarding the radio-electrical industry, very important agreements for the French radio-electrical industry were signed on December 31st, 1928, between the Compagnie Générale de T.S.F. and "Le Matériel Telephonique," a French branch of the International Telephone and Telegraph Corporation. Under the terms of these agreements, which will come into force on April 1st next, the Compagnie Générale de T.S.F. and its branches and French associated companies will have the rights for France and her colonies, protectorates and mandates, and for all applications in the field of radio, to all patents, patent rights, and inventions, which Le Matériel Telephonique now possesses, or may hereafter possess. The latter will receive rights under the patents and inventions of Compagnie Générale de T.S.F. for certain foreign countries. Technical co-operation between the two company groups will make these agreements effective. In consequence of these agreements the Compagnie Générale de T.S.F. and its branches, Radiotechnique, Radiola, &c., will sell to the French public, in addition to their own apparatus, that of the L.M.T. (loud-speakers, radio equipment, &c.).

A Floating Electric Power Station.

A recent issue of an A.E.G. journal contains a short description of an interesting floating Diesel engine power station recently equipped by the A.E.G. concern, for the supply of power for the construction of a lock on an island waterway near Berlin. The station is equipped with three M.A.N.



A Floating Power House.

airless-injection, four-stroke, four-cylinder Diesel engines, each developing 150 b.h.p. at 300 r.p.m. directly coupled to A.E.G. three-phase alternators, each with an output of 125 kVA at 400 volts, 50 cycles. There is also an auxiliary set for an output of 10 kVA. The work on the lock has now been proceeding without a hitch for nearly eighteen months, without any failure in the supply of current to the pumps. Although only four-cylinder Diesel engines were installed, the vibration of the hull of the boat is stated to be not very noticeable. It is, however, recommended that six-cylinder engines should be used with a view to a more favourable distribution of the stresses on the float.

Association of Consulting Engineers.

The annual general meeting of the Association of Consulting Engineers was held in London on May 27th, Mr. H. Howard Humphreys being in the chair. The report of the Committee for 1928-29 shows that during the year two members died, three resigned, and thirteen new members were added, so that the membership is now 123. The accounts show that the income, £512, balances the expenditure.

Prevention of Fumes from Power Station Chimneys.

The *Liverpool Post and Mercury* reports that during a discussion at a meeting of Liverpool City Council on June 5th on the possible danger to public buildings from noxious fumes and grit emitted by the proposed station at the Clarence Dock, it was stated that Mr. P. J. Robinson, the city electrical engineer, had discovered and patented a device which would mitigate, if not abolish, acid fumes, such as sulphur dioxide, and all perceptible grit and dust. The device had been submitted to two scientific experts, who were satisfied that it would fulfil what was required of it.

Low-temperature Carbonisation.

The systematic study of the low-temperature coal carbonisation processes promised to be of material assistance in restoring the prosperity of the coal fields, said Dr. M. A. Matthews in the course of a recent lecture at the Sir John Cass Technical Institute, London. Dr. Matthews pointed out that the fact that there were at present in Great Britain 43 companies, representing a capital of eight million pounds sterling, directly interested in the low-temperature carbonisation of coal showed how commercially important the processes had become. When the chemical nature of low-temperature tar was more fully understood there could be no doubt that many further uses would be found for it. Among the products which could be obtained from low-temperature tar were lubricating oils, fuel and Diesel oils, powerful disinfectants from tar acids, and resins suitable for use as paints, varnishes, insulating material, &c., while the pitch had been found useful in the manufacture of roofing material and as a binding agent for patent fuel.

It is announced that work has just begun on the erection of extensive refineries on the banks of the Humber at Killingholme, where British low-temperature tars will be treated by the gyro vapour-phase cracking process. Capital to the extent of nearly half a million pounds has been subscribed for this important project of motor-spirit and oil-fuel production from British coal oils.

Appointments Vacant.

Borough electrical engineer (£1,000) and distribution assistant for the Torquay Corporation. Mechanical draughtsman for Electrical Department of Buenos Ayres and Pacific Railway. Power-station shift engineer for Hastings Corporation. Wireless engineer for the Government of Nigeria. Teacher in electrical engineering at Jarrow secondary school. Stores clerk for Basingstoke Electricity Department. Assistant electrical engineer for Clacton Urban District Council. (See our advertisement pages to-day.)

Safety of Life at Sea.

A plenary session of the International Conference on Safety of Life at Sea was held at the Foreign Office, London, on May 31st for the purpose of considering the adoption of the Convention which had been prepared as a result of the discussions in Committee during the period since the Conference opened on April 16th (see ELEC. REV., April 26th, p. 768.)

Vice-Admiral Sir Herbert Richmond, K.C.B., President of the Conference, was in the chair, and the meeting included the delegates of all the Governments represented at the Conference. Senator Rio (French Delegation) having presented the draft Convention, and the chairman of the technical committees of the Conference having spoken in turn to the effect that the draft carried out the views of the committees over which they had presided, Admiral Richmond moved the adoption of the Convention. In the course of his summary of the work of the Conference he said, according to the *Board of Trade Journal*, that the great importance of radio-telegraphy as a means of promoting safety of life at sea had been fully demonstrated in 1914, and in the years that have passed there had been remarkable developments. A comparison of the Berne international list of ship radio stations with Lloyd's register of shipping showed that, out of the total of 11,000 merchant steam ships and motor ships of 1,600 tons gross and upwards owned by the maritime countries of the world, no less than 10,000 were so equipped. To make the equipment fully effective for life-saving purposes, however, it was not sufficient that a ship in distress should be able to send out calls for assistance. Provision must be made for the reception of such calls by other ships in a position to render aid. The Conference, therefore, devoted a great deal of time to the organisation of "watch keeping" on all vessels carrying the equipment. The organisation at which the Conference had aimed had been greatly facilitated by recent developments in regard to the automatic alarm signal. The International Radio Convention, signed at Washington in 1927, prescribed the conditions with which such apparatus must comply before it could be accepted as effective. After exhaustive tests made by the Naval and telegraphic services of different nations, several types of apparatus had been accepted as complying fully with the Washington requirements, and automatic alarms of those types had for some time proved their efficiency on a large number of both passenger and cargo ships. In the circumstances the Conference had been able to bring under the Convention in regard to radio-telegraphy, subject to certain conditions of exemption, all ships engaged in internatonal voyages, except cargo ships of less than 1,600 tons gross.

It may be added that the Institute of London Underwriters recently agreed to suspend the additional premiums charged on the insurances of vessels calling at St. John, New Brunswick, when equipped with wireless direction-finding apparatus.

Sweden's Largest Power Station.

The Hammarsforsen power station, the latest and most modern in Sweden, has been put into operation. Situated in the north of Sweden in the most important sawmill and pulpmill districts of Sundsvall and Hernoesand, to which it supplies electrical energy, it belongs to the well-known Kreuger and Toll Company. The plant is now designed for three water turbines, each of about 16,000 h.p. capacity, with facilities for future extensions. The installation has been made and the equipment delivered by the Nydqvist and Holm and the Asea concerns. In 1796 the great Indal River, of which Hammarsforsen is a part, formed a lake with an area of twelve square miles, called the Ragunda Lake, at the outflow of which there was a cataract, called Storforsen, 130 feet high, one of the most imposing waterfalls in Europe. The Storforsen, however, caused considerable trouble to the timber-floaters, as their logs were often dashed to pieces by its violence. They therefore began to dig a by-pass canal for timber floating and thereby unexpectedly caused a catastrophe, which in one single night emptied Lake Ragunda of its 35,000 million cubic feet of water, silenced the Storforsen Falls for ever, and made the river cut itself an entirely new course down to the sea. The water had been deflected into the new canal dug by the lumbermen, a forty-feet-high wave of water swept along everything in its way: trees, sawmills and entire farms. The bottom of the former lake is now fertile farmland, and of the Storforsen, now called the "dead falls," there remain only empty cauldrons and curious rock formations cut by the torrent which came to such a sudden end. In the new course of the Indal River the Hammarsforsen Falls were formed, together with several others, and it is intended to build new plant and enlarge the Hammarsforsen one, whereby delivery of electrical energy over long-distance lines to the southern and central parts of Sweden will be possible.

Motor-car Testing.

Engine testing at the Hillman motor car works at Coventry has recently been improved, due to the installation of automatic electrical testing sets specially designed and manufactured by the General Electric Co., Ltd. Six of the sets have been installed, each consisting primarily of a large steel-plate cubicle which accommodates the electrical testing machine (which runs either as a motor or generator) in the lower part, and the various control apparatus in the upper part. The control apparatus comprises a main contactor panel and various relays, grid resistances, meters, push buttons, speed-regulating handles, &c., and above the cubicle is a series of coloured lamps, so that the stage of the test which is being carried out may be ascertained at a glance. On each side is a seating, on to one of which an engine may be readily clamped while another engine on the other seating is under going test, and running in either direction of rotation can be obtained with ease. The electrical machine first drives the engine in order that the wearing parts may become eased; subsequently the engine is fitted with a carburettor, plugs, magneto, &c., and it is then started in the usual way, and drives the electrical machine, which functions as a generator and feeds back to the line. The testing set thus fulfils the dual function of giving a preliminary "conditioning" run while subsequently it enables the engine to be thoroughly tried under load conditions. The whole of the motoring run is controlled by a special sequence drum, which governs the speed from its initial value of 300 r.p.m., accelerating gradually as required until 50,000, or any other fixed number of revolutions has been completed, when one of the special signal lamps is lit. Automatic relays safeguard both engine and apparatus, one cutting off the current to the machine if the engine shows signs of seizing, and another preventing any acceleration if the initial friction does not decrease at a certain rate. The pressing of a second button enables the electrical machine to be connected to a section of the resistance grids in order that the engine may be run very slowly under its own power while adjustments are being made to the valve tappets, &c., in readiness for the full-speed generating run. The latter is accomplished by pressing the "re-start" button, when the set automatically speeds up again and the engine begins to fire. It is caused to feed back into the line by the simple adjustment of a hand wheel, and then the final run takes place, during which the engine under test supplies some proportion of the electrical power required in the factory. The apparatus is safeguarded by relays, to take care of any overload, shut down the set if the field circuit of the generator were to fail, and come into action if the connection to the electricity main were to be broken, either of which faults would remove the load from the engine. By means of an automatic paralleling device and field relay, should an engine seize, it would be disconnected from the line, but should it overcome the trouble it would pick up its load again. As rotation in both directions can be provided, separate accelerating contacts are fitted with interlocks, so as to function only for the correct direction of rotation in each case. Further, the set will test engines of four and eight cylinders, one change-over switch making all the necessary modification in the circuit. Another useful provision is swivelling meters, so that they are conveniently in sight of the tester at either side.

A Large Electric Generator.

One of the largest generators of electric power in the world was formally placed in operation at the Hell Gate station of the United Electric Light and Power Company in New York City, U.S.A., on May 29th. The machine, built by the Westinghouse Electric and Manufacturing Company, has a capacity of 165,000 kilowatts, or approximately 222,000 horse-power. The next largest set, which is located in the same station, is rated at 214,000 horse-power, while the next in size develops less than 150,000 horse-power. In comparison, the world's largest water-power generator develops about 80,000 horse-power. The set is remarkable for its compactness, rather than

its size; close by in the same station is a 67,000-horse-power machine which was installed a few years ago, and although the new set develops more than three times the power of the older one, it is less than twice as large. In constructing the machine, a new type of insulation was developed and arc-welded steel shapes were largely employed in place of iron castings. The studs which hold the two halves of the high-pressure cylinder together were drilled with stepped holes in order to permit the insertion of special instruments to give the studs precisely the right tension and to check the tension by exact measurements.

The set is of the cross-compound type, that is to say, one turbine is operated by high-pressure steam and the other by steam exhausted by the first. Each turbine drives an electric generator rated at 80,000 kilowatts and, in addition, the low-pressure turbine drives a third generator, which is rated at 5,000 kilowatts and supplies power for use in the station. The two main generators are enclosed in a single semi-circular housing into which cooled air is blown for ventilating purposes, which gives them the appearance of a single machine. Steam is supplied at 265 lb. gauge pressure and 700 deg. F. total temperature, and is discharged into the condenser at a pressure of 1 inch mercury absolute. To condense it, 155,000 gallons of cooling water are pumped through the condenser every minute. The dimensions of the set are: length 91.5 ft., width 40 ft., height above floor line 27.5 ft., weight 1,300 tons, speed 1,800 revs. a minute. The Hell Gate station is now said to be the largest power house in the world, with a total capacity of over 800,000 horse-power; of the nine sets in operation there, five were supplied by the Westinghouse Company.

North-East Coast Exhibition Floodlighting.

As we have already pointed out, one of the principal attractions of the North-East Coast Exhibition is the wonderful coloured flood-lighting of the buildings and grounds. The scheme, which is claimed to be the most extensive and effective scheme of coloured floodlighting ever attempted in this country, should contribute in no small measure to the success of the Exhibition. At dusk thousands of visitors remain especially to see the switching on of row upon row of B.T.H.

Floodlighting Effects at N.E. Coast Exhibition.

floodlight projectors from which coloured beams of light flash out until within a minute or two the whole of the Exhibition buildings and the grounds are bathed in soft multi-coloured light. In the general floodlighting colour scheme, amber predominates, while the colour effects in the floodlighting of the Palaces of Engineering and Industries include all the hues of the rainbow, producing some remarkable and artistic contrasts. The accompanying illustrations of the lighting cannot do more than give a slight impression of the actual effects, which must be witnessed to be appreciated. The whole of the floodlighting sheme was arranged by the British Thomson-Houston Co., Ltd., in conjunction with the consulting engineers, to the approval of the architect, Mr. Millburn.

A Compressed-Air-Break Switch.

Before the Berlin Electrotechnical Association on May 28th Herr Biermann delivered a lecture on what was stated to be a promising invention of the Frankfort electrical engineer, Prof. S. Ruppel. The subject was a new kind of large switch for controlling electrical circuits, which functions in compressed air, in place of the customary oil-break switch. It is claimed that the advantage of this form of switch specially lies in the avoidance of the danger of explosions. Moreover, the use of the new switch will render superfluous the import of considerable quantities of oil from abroad. It is stated that already efforts have been made in America to develop a compressed-air switch, but without success. The problem is said to have first been solved by Herr Ruppel through a special constructive improvement of the compressed-air nozzle and the development of the switch which, in extensive tests, it is claimed, has resulted in attaining the efficiency of the largest oil-break switch.

A New Ceylon Power Station.

The Stanley power station, Colombo, Ceylon, the new power station erected by the Department of Electrical Undertakings at Kollonnawa, was officially inaugurated by the Governor of Ceylon on March 5th. Mr. S. Pitkeathly, director of the Electrical Undertakings, who introduced the Governor, said that the completion of the station was the first important step in the electrical development of the colony. It had been designed to meet the needs, not only of the inhabitants of Colombo, but also of those who lived much further afield. It also formed an integral and most important part of the Laxapana hydro-electric scheme. He paid a high tribute to the work of Mr. Wimalasurendra, who, in collaboration with Messrs. Preece, Cardew & Rider, consulting engineers, was responsible for the design and layout of the whole station.

B.S.S. for Keys and Keyways, Splines and Serrations.

An enlarged and comprehensive British Standard Specification in two parts, No. 46, parts 1 and 2, 1929, covering all types of keys, has now been published in two parts by the British Engineering Standards Association. A specification for steel key bars of four different qualities of steels is included in part I, which supersedes the 1909 and 1924 editions, and tables of dimensions are given for the following types of keys and keyways: rectangular and square parallel keys; rectangular and square taper keys; plain and gib-head taper keys; pegfeather keys; woodruff keys; and tangential keys. A standard for the taper and method of keying for coned shaft ends is also included.

Part 2 covers splines and serrations, and tables of dimensions have been drawn up for the following spline shafts and the corresponding holes: 4 and 6 splines (shallow and deep); multiple splines; and serrations. The table of multiple splines has been prepared on the basis of 8 splines per inch diameter, and is put forward as a tentative standard.

In both parts of the specification there is a fully illustrated nomenclature section in which definitions are given for all the various types of keys. It is hoped that this section, which has been prepared in the closest collaboration with industry, will result in uniformity in the use of terms, and it should prove of great value to engineering colleges and technical institutions in particular.

Copies of each part may be obtained, price 2s. 2d. each, post free, from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1.

The Consumption of Electricity.

Returns recently rendered to the Electricity Commissioners show that the amount of electricity sold to consumers by authorised undertakers in Great Britain in the year ended December 31st, 1928, was 7,602 million kWh, representing an increase of 752 million kWh, or about 10.9 per cent. on the figure for the previous year. Comparative figures for the period 1922 to 1928 are set out below. They represent the amount of electricity retailed direct to consumers and are exclusive of intersales in bulk between authorised undertakers.

Year.	KWh sold to consumers. Millions.	Increase on previous year. Actual. Millions.	Per. cent.
1922 ...	3,645 ...	— ...	—
1923 ...	4,339 ...	694 ...	19.0
1924 ...	4,998 ...	659 ...	15.2
1925 ...	5,515 ...	517 ...	10.3
1926 ...	5,724 ...	209 ...	3.8
1927 ...	6,850 ...	1,126 ...	19.6
1928 ...	7,602 ...	752 ...	10.9

Over a period of six years, since 1922, the annual sale of electricity to consumers by authorised undertakers in Great Britain has thus increased at an average rate of about 660 million kWh per annum.

Institution Notes.

Institution of Electrical Engineers.

The Société Française des Electriciens has drawn up an excellent programme of visits for the party of members of the Institution of Electrical Engineers which left London this week for Paris. On Wednesday, June 12th, visits were to be paid to the electric power stations at St. Ouen and Gennevilliers, the million-volt laboratory of the Compagnie Electro-Ceramique at Ivry, and the Ecole Superieure d'Electricité, while in the evening a banquet was to be held. On Thursday the morning was to be devoted to a visit to the wireless telegraphy station at Ste. Assise, and the afternoon to a pleasure trip to the Palace of Versailles. On Saturday, June 15th, the visits will include the new power station at Issy-les-Moulineaux, and the Office des Inventions at Bellevue to see the big electro-magnet which has been installed there. On June 16th the party will proceed to Eguzon by special train to inspect the hydro-electric power station at that place, afterwards proceeding to Bordeaux. On June 17th Pau will be visited in order to see one of the rectifying stations of the Midi Railway, the following day being devoted to an inspection of other electrical plant connected with that railway. June 19th will see the visitors at Pierrefitte-Nestalas and Lux, where other works will be inspected; on June 20th a visit will be paid to a nitrogen factory at Lannemezan, the outing concluding with a pleasure trip to the walled city of Carcassonne and to Toulouse.

The Students' Section summer tour will be held this year in Paris and Northern France, commencing on August 3rd and finishing in London on August 13th. The programme is as follows:—Leaving London on the afternoon of August 3rd, Saturday night and Sunday will be spent at some French seaside resort. Monday and Tuesday will be spent in visiting a rural electrification scheme area around Calais, after which the party will proceed to Rheims through the battlefield area. An insulator factory will be visited in Rheims, and the party will then proceed to Paris, where it is hoped to include visits to a generating station, a radio station, a telephone factory, an aerodrome, and several other places of general interest. It is estimated that the cost of hotel expenses and travelling will not exceed £12 per person

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. H. F. G. WOODS, borough electrical engineer of Torquay, takes up his new appointment as general manager of the East Devon and Exe Valley Electric Supply Company this week.

At the first meeting of the new committee, Mr. NICHOLAS G. GEDYE, O.B.E., B.Sc., M.Inst.C.E., was elected chairman of the committee of the Association of Consulting Engineers (Incorporated) for the ensuing year.

The Bristol Corporation Salaries Committee recommends increasing the salary of Mr. T. H. GAIT from £500 to £600 per annum.

Mr. J. B. HILL, B.Sc., Dundee, has received an engineering appointment in connection with a Brazilian hydro-electric development in that country. Mr. Hill was formerly with the Metropolitan-Vickers Electrical Co., Ltd.

Mr. D. M. PITT has relinquished his post with the Cambridge Instrument Co., Ltd., to return to the domestic side of the industry as London sales manager to Electrical Utilities, Ltd.

The *Sydney Morning Herald* reported on May 1st that Mr. A. MAUGHAN, managing director of the Australian General Electric Co., was leaving on the following day for the United States. He is to visit England.

Having completed 25 years in the service of the English Electric Co., Ltd., at Stafford, Mr. J. W. BRIGGS, superintendent of the Switchgear Department, has been presented upon his retirement with a gold English lever watch, a wallet containing Treasury notes, and a handbag for Mrs. Briggs. Mr. C. E. Fairburn, general manager, made the presentation.

The Stockport Town Council has confirmed the appointment of Mr. G. H. OLDROYD as deputy electrical engineer, with an increase in salary from £650 to £700 per annum. Mr. Oldroyd was appointed on probation for one year.

It is reported that Capt. Eckersley, chief engineer of the B.B.C., whose resignation is referred to in our leaderette pages, will be succeeded by Mr. NOEL ASHBRIDGE, B.Sc., assistant chief engineer. Mr. Ashbridge has been associated with Capt. Eckersley for several years, having occupied a position at the Writtle station of the Marconi Company.

On Wednesday, last week, the Sheffield City Council confirmed the appointment of Mr. E. MORGAN, borough electrical engineer of Wolverhampton, as chief engineer and general manager of the Sheffield Electricity Department in succession to Mr. S. E. Fedden.

Mr. ALAN KIRK, A.M.I.E.E., has relinquished his appointment with Engineering Works (Electrical and General), Ltd., and has joined the staff of Messrs. Troughton & Young, Ltd., Knightsbridge, S.W.1.

Obituary.—SIR SYDNEY HUTCHINSON.—The death occurred at West Kensington on June 10th of Sir Sydney Hutton Cooper Hutchinson, late Director-General of Telegraphs in India. Sir Sydney, who was 76 years of age, received his early training under Sir William Preece and joined the Indian Telegraph Service in 1871; he became Director-General in 1905 and retired two or three years later. He was a member of the Institutions of Civil and Electrical Engineers.

Will.—Mr. DAVID D. WARREN, the late chairman of the Metropolitan Electric Cable & Construction Co., Ltd., left personal estate valued at £324,522.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Metro Stores, Ltd.—Private company. Registered June 3rd. Capital, £2,000 in £1 shares. Objects: To acquire the business carried on at 302b, Kentish Town Road, N.W., as the Metro Stores, to adopt an agreement between H. A. Hough and S. E. Boyden, and to carry on the business of manufacturers of and dealers in electrical, magnetic, galvanic, wireless, and other apparatus, gramophones, kinematographs, sound and light receiving, recording and reproducing devices, loud speakers, radio transmitting and receiving apparatus, musical instruments, mechanical and electrical engineers, &c. The first directors are:—S. E. Boyden, 1, Palmeira Avenue, Westcliff-on-Sea, merchant (director of Boyden & Smith, Ltd.); R. A. Croston, 162, Westborough Road, Westcliff-on-Sea, solicitor.

Vibratone Co., Ltd.—Private company. Registered June 6th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of, and dealers in all kinds of electrical instruments, apparatus, machines, accessories, and goods, &c. The subscribers (each with 1 share) are:—A. E. Flint, 140, Tollington Park, N.4, clerk; J. A. Woodhouse, 58, Victoria Road, New Barnet, Herts., solicitor's clerk. The first directors are to be appointed by the subscribers. Secretary: G. Peckham. Solicitors: E. C. Kilsby & Son, 21, College Hill, E.C.4.

"K.K." Syndicate, Ltd.—Private company. Registered June 8th. Capital, £100 in 1s. shares. Objects:—To acquire the invention No. 16,360 of 1929 relating to electrical storage batteries and the like, and to carry on the business of electrical and general engineers and manufacturers, &c. The first directors are:—E. B. Howard, secretary; and B. Quint, engineer, both of 19, Cousin Lane, E.C.4.

Electrolytic Spelter Co., Ltd.—Private company. Registered June 8th. Capital, £10,000 in £1 shares. Objects:—To carry on the business of merchants, brokers, metallurgists, and dealers in metals of all kinds, producers, workers and sellers of metals and metallic substances or products, founders of zinc and any other metal, platers of zinc or other metal by hot or electrolytic process, &c. The subscribers (each with one share) are:—E. J. Burrows, 29, Lyndhurst Road, Highams Park, E.4, solicitor's clerk; E. L. Davies, 1a, Herbert Road, Plumstead Common, S.E.18, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.2.

Geo. Crossley & Son, Ltd.—Private company. Registered June 10th. Capital, £2,000 in £1 shares. Objects:—To acquire, as from April 5th, 1929, the business of dealers in electrical accessories carried on by G. Crossley and G. B. Crossley as the Crossley Electric Co. at 4, South Street, Manchester, and to carry on the same and the business of electric light, power and radio engineers, manufacturers and installers of wireless apparatus, heating accessories, departmental telephones, electrically-illuminated signs, electric bells, &c. The first directors are:—G. Crossley, "Marshmead," Bramhall, Ches.; G. B. Crossley, "Marshmead," Bramhall, Ches. Registered office: 4, South Street, Manchester.

T. G. Hunter & Sons, Ltd.—Private company. Registered June 6th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, electrical, mechanical, heating and domestic engineers and general ironmongers, &c. The subscribers (each with one share) are:—T. G. Hunter, 2, St. James's Square, Manchester, engineer; Miss G. P. Hunter, Langley House, Victoria Park, Manchester. T. G. Hunter is sole permanent governing director. Registered office: 3, St. James's Square, Manchester.

Easitime, Ltd.—Private company. Registered June 1st. Capital, £1,000 in £1 shares. Objects:—To acquire the business of a merchant and dealer in electrical appliances, &c., heretofore carried on by C. J. L. Green at 45, Hallewell Road, Edgbaston, Birmingham. The directors are:—C. J. L. Green, 45, Hallewell Road, Edgbaston, Birmingham; W. K. Powell, "Kennersley," Stanway Road, Shirley, Birmingham. Secretary: W. K. Powell.

Northern Cables, Ltd.—Private company. Registered June 5th. Capital, £500 in £1 shares. Objects:—To carry on the business of electricians, electrical, mechanical and general engineers and contractors, manufacturers of, and dealers in wireless component parts and accessories, telegraphic, telephonic, wireless and television apparatus and appliances, wires, cables, batteries, dynamos, generators, accumulators, &c. The directors are:—J. R. Ellison, "Hollinbank," Heckmondwike, Yorks., chemical manufacturer; E. H. Crowther, "West Holme," West Park Street, Dewsbury, rag merchant; G .H. Carter, 17, Silver Hills Drive, Bradford, electrical engineer. Registered office: Wells Mills, Northgate, Huddersfield.

Official Returns of Electrical Companies.

James Keith & Blackman Co., Ltd.—Satisfaction in full on May 15th, 1929, of debentures dated December 10th, 1901, to May 6th, 1919, securing £4,550.

Gravesend Welding & Electrical Engineering Works, Ltd.—Capital, £1,500 in £1 shares. Return dated May 15th, 1928 (filed January 31st, 1929). 1,200 shares taken up. £1,200 considered as paid. Mortgages and charges, nil.

County Electrical Co. (Pendleton), Ltd.—Capital, £2,000 in £1 shares. Return dated July 16th, 1928. 1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Portable Accumulators, Ltd.—Capital, £4,400 in 4,000 preference shares of £1 each and 8,000 ordinary shares of 1s. each. Return dated December 31st, 1928 (filed February 6th, 1929). 3,300 preference and 7,474 ordinary shares taken up. £2,668 14s. paid (14s. per share on 3,300 preference and 1s. per share on 7,474 ordinary). £15 calls unpaid. Mortgages and charges, nil.

Southwold Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated May 27th, 1929. 16,654 shares taken up. £154 paid. £16,500 considered as paid. Mortgages and charges, nil.

Mold Accumulators, Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated October 5th, 1928 (filed April 27th, 1929). 350 preference and 363 ordinary shares taken up. £713 paid. Mortgages and charges, £200.

Reilly & Brookes, Ltd.—Capital, £2,500 in £1 shares. Return dated June 19th, 1928 (filed February 7th, 1929). 1,940 shares taken up. £1,940 paid. Mortgages and charges, nil.

C. Barnett, Ltd.—Debenture dated May 22nd, 1929, to secure £1,000 charged on the company's property, present and future, including uncalled capital (subject to £1,000 first debentures, but ranking *pari passu* with a second debenture for £250). Holder: C. Manning, 5, Great Chapel Street, W.1.

Record Corporation, Ltd.—Capital, £35,000 in 20,000 ordinary shares of 10s. each and 25,000 preference shares of £1 each. Return dated February 26th, 1929. 20,000 ordinary and 10,252 preference shares taken up. £10,252 paid on the preference shares. £10,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

Upfields Wireless, Ltd.—Capital, £300 in £1 shares. Return dated March 26th, 1929. All shares taken up. £300 paid. Mortgages and charges, nil.

Great Western Ignition Co., Ltd.—Capital, £2,000 in £1 shares. Return dated March 21st, 1929. 950 shares taken up. £950 paid. Mortgages and charges, nil.

C.A.C. Valve Distributing Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1928 (filed February 2nd, 1929). All shares taken up. £2 paid. £98 considered as paid. Mortgages and charges, £250.

William Simms & Co. (Felixstowe), Ltd.—Capital, £4,000 in £10 shares. Return dated January 31st, 1929. 203 shares taken up. £30 paid. £2,000 considered as paid. Mortgages and charges, nil.

Grosvenor Battery Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 10th, 1929. 3,000 shares taken up. £3,000 paid. Mortgages and charges, nil.

Mersey Cable Works, Ltd.—Capital, £40,000 in 10,000 preference and 30,000 ordinary shares of £1 each. Return dated December 12th, 1928. 19,901 ordinary shares taken up. £19,901 paid. Mortgages and charges, £12,500.

Park Royal Engineering Co., Ltd.—Mortgage on the premises at Park Royal Engineering Works, Cumberland Avenue, Willesden, dated May 21st, 1929, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £12,000.

City Notes.

Callender's Cable and Construction Co., Ltd.

The accounts of this company were abstracted in our issue of May 31st (p. 977), and the annual meeting was held on June 6th, Sir J. Fortescue Flannery (chairman), who presided, referred with regret to the death of Mr. E. Gurney Buxton, a director. Turning to the past year's working, he said that during 1928 there was some restriction on the cable industry, and few large contracts were placed for heavy mains. Most of those engaged in electricity supply held their hands pending the completion of the Government "grid" scheme. The company had secured a contract for the southern section of England, and this contract represented a value of approximately £500,000. Owing to wayleave difficulties, the scheme had not been put in hand until the last few weeks, but work on the first section of the mains near the South Coast was now in full operation. The effect of the "grid" would be to increase the quantity of underground cable required for distribution and general services. The orders obtained for ordinary underground cables and for the wires and cables required inside premises represented a satisfactory business, which tended to increase. Progress had been made by the technical staff in research work to assist in producing cables for service at still higher pressures than those now employed, and this had been of assistance to the company in obtaining the order for 66,000-V mains, recently placed, to connect the various local generating stations in London, thus also giving to these stations supply from the Government network. One of the three such districts in London had been entrusted to the company. The overseas business was increasing, and during the year a contract for the cables for the new dockyard at Takoradi was carried out; and both on the Gold Coast and in Nigeria considerable developments of electricity were taking place by means of mains manufactured at the Erith works. The establishment in India had been fully maintained, and in all parts of that country, as also in the Malay States, steady and continuous progress was being made. In China a certain amount of business was being done, in spite of the terrible condition in which that country still remained, and the wisdom of maintaining throughout that difficult period the branch in Shanghai was being fully justified. The factory at Erith had, therefore, been well supplied with work, but the company could have done with more had heavy-mains contracts been more plentiful. An unusually large amount of rubber work had been manufactured at the Anchor works, the output, excepting for the war years, proving a record one, not only in sales in this country, but also in export to the Dominions and foreign countries. There was every indication, both at Erith and Leigh, that the production for the current year

would be highly satisfactory. Referring to the purchase of W. T. Glover & Co., Ltd., he said that the negotiations were brought to a critical state by the information that other important firms, both British and foreign, were anxious to purchase. The amount involved was over £1,000,000, and as a decision in the matter had to be taken immediately, sufficient shares in the company were sold to a leading firm of bankers to provide the prompt cash. Some of the company's friends in the industry became interested in the purchase, but the provision of the sum had to rest with Callender's alone, and the payments were made in the early part of this year. As a result of the association with other cable manufacturers in research and investigation, substantial economies had already been introduced which had reduced manufacturing costs and prices. Reports regarding the Okonite-Callender Cable Co. showed that the use of the American company's cables was steadily increasing. It was proposed to establish a pension fund for employés and to set aside £10,000 as a first contribution towards it. After the payment of dividends, the amount carried forward would be £570,246, so that there would be in reserve and carried forward a sum of approximately £1,000,000, part of which it was proposed to capitalise.

In seconding the adoption of the report and accounts, Sir Tom Callender (deputy chairman) referred to the forthcoming E.H.P. Conference in Paris and the honour which had been paid to the company by the selection of Mr. Hunter, as representative of the Institution of Electrical Engineers, and Mr. Watson, head of the research department, to read a paper on the expansion of conductors in super-tension mains. He also referred to various contracts placed with the company in India, South America, &c., particularly the electric lighting of Benares and Jerusalem.

The report and accounts were adopted, and the proposal to capitalise £186,000 from the reserve fund and to issue it in the form of fully-paid ordinary shares to the ordinary shareholders, in the proportion of one new share for each five held, was approved.

Lancashire Electric Light and Power Co., Ltd.

The annual meeting was held on June 3rd. Mr. A. Shepherd (chairman) presided, and in presenting the report and accounts of the company and its associate, the Lancashire Electric Power Co., said that with regard to the power stations at Radcliffe and Padiham, the plants had run well throughout the year, the maximum load at Radcliffe having risen from 48,200 to 51,400 kW, and at Padiham from 13,000 to 16,500 kW. There had been no extensions to the 33,000-V system, but the 11,000-V system had been increased by about six miles and the 2,000/3,000-V mains by nearly eight miles, the greatest activity being in connection with the l.p. supplies; over 48 miles of new distributing mains had been provided during the year. The electrical energy sold had increased by 17.7 per cent. from 175,433,756 to 206,608,807 kWh. Referring to the Kearsley station which was in course of erection, the complete scheme for this station consisted of four units of 42,000 h.p. each, but it was capable of extension, and it was anticipated that so far as the first two units were concerned the station would be in operation in the autumn of this year. Up to March 31st last approximately £390,000 had been expended on this station, and a further sum of £500,000 would be required to complete it. In addition to this sum, further expenditure on mains, &c., in connection with the general progress of the company would, to December 31st next, call for a further amount of £400,000. Under the North-West England and North Wales scheme, the company's three generating stations were all "selected," and it was expected that both Kearsley and Padiham would be operated as base-load stations, in which event some extension of boiler plant at both stations would be necessary. The report and accounts were adopted.

Electric Supply Corporation, Ltd.

The accounts for the past year show gross earnings of £109,100 and a net profit of £53,563, as compared with £54,996 in 1928. Of this, £4,389 is transferred to the renewals and depreciation fund, and it is proposed to pay a final dividend of 7 per cent. on the ordinary shares, making 11 per cent. for the year, as for 1928. The Dollar and Jedburgh undertakings have been disposed of and the net proceeds have been transferred to the depreciation fund. The Hitchin undertaking has changed over to bulk supply. During the year the whole of the share capital of the Steyning Electric Light Co. was acquired at 21s. 6d. per share. Applications have been made for Special Orders extending the areas of the Alton, Haywards Heath, Petersfield and Steyning undertakings; and to authorise the transfer of the Exmouth undertaking to a local company in exchange for shares. Arrangements have been made to dispose of these shares and those of the Wellington Company upon satisfactory terms. Meeting: June 17th.

International Aluminium Co., Ltd.

The annual meeting was held on June 4th, Mr. K. M. Clark (chairman) presiding. Referring to the company's activities in Norway, the chairman said that their associated company—A/S Haugvik Smelterverk—installed and brought into commercial operation an up-to-date aluminium factory which produced during 1928 upwards of 4,000 tons of metal. Early last year, when conditions were favourable, the second stage of the development in Norway was proceeded with, and this factory was brought into operation at the beginning of this year. The factories in Norway were, therefore, now producing 8,000 tons of metal per annum, with a corresponding reduction in manufacturing costs. The works at Hebburn-on-Tyne continued to produce alumina at full capacity at reasonable costs, and were well maintained. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Aeonic Radio, Ltd.—1,250,000 new shares of 2s. each, fully paid, Nos. 2,250,001 to 3,500,000.

Brompton and Kensington Electricity Supply Co., Ltd.—21,432 ordinary shares of £1 each, fully paid, Nos. 351,017 to 372,448.

Underground Electric Railways Co. of London, Ltd.—4,702 ordinary shares of £1 each, fully paid, Nos. 7,159,907 to 7,164,608.

Madras Electric Supply Corporation, Ltd.

The net profit for the year ended December 31st, 1928, was £65,935 (against £63,667 for 1927), after providing £25,000 for depreciation and renewals (against £18,000). The addition of £6,656 brought forward makes available £72,591, and after transferring £9,855 to general reserve it is proposed to pay a final dividend of 5½ per cent., free of tax, on the ordinary shares, again making 8 per cent., tax free, for the year. A balance of £6,906 is carried forward. The meeting was held on Wednesday last.

Cia. Hispano-Americana de Electricidad.

Speaking at the recent annual meeting in Madrid, Mr. F. de A. Cambo (president) said that the dividend had been raised from 14 to 15 per cent. (gold). The conservative dividend policy of the company had enabled it, without straining its cash resources, to construct a great modern super-station in Buenos Aires. Excellent results were being obtained from that station, thanks to the expert technical management of the Société Financière de Transport et d'Entreprises Industrielles, of Brussels.

Marconi's Wireless Telegraph Co., Ltd.

The Committees representing the holders of the company's £1 ordinary and preference shares propose to form an investment company to exchange its shares with the Marconi shares. The shares will be of 5s. denomination to render them more easily marketable. Further action is suspended, however, until the result of the proceedings which the Venture Trust, Ltd., is taking against the Marconi Co. is known.

Great Northern Telegraph Co., Ltd.

At the general meeting in Copenhagen, on June 7th, the chairman stated in reply to a shareholder that a settlement of the account outstanding with the Japanese Administration, referred to in last year's report, had recently taken place through the payment to the company of approximately £143,000, by which amount the revenue for 1929 would be augmented.

Electric Construction Co., Ltd.

This company's financial results for the past year were given in our issue of May 31st (p. 977). The report states that the increased demand for electrical products referred to last year was maintained, and the volume of work produced by the company exceeded that of any previous year. Competition, however, has been keener than ever, and selling prices have been so reduced as to leave little or no margin over the cost of production.

Ruston & Hornsby, Ltd.

The net profit for the year ended March 31st last was £82,709, after providing for depreciation and debenture interest (against £73,096). The ordinary dividend is maintained at 2½ per cent., free of tax, and the carry forward is increased from £24,157 to £32,116.

General Electric Co. (America).

In addition to the regular dividend of $1 per share, the common stock is to receive an extra dividend of $1 per share. The dividend on the special stock is 15 per cent.

Leatherhead and District Electricity Co., Ltd.

An issue of £20,000 of 5½ per cent. first mortgage debentures is being made by the company.

O. C. Hawkes, Ltd.

An interim dividend of 3 per cent. has again been declared on the ordinary shares.

Calcutta Tramways Co., Ltd.

The accounts for the year ended December 31st, 1928, record a profit of £180,990, as compared with £163,349 for 1927. To this is added £7,758 brought forward, making £188,747. After meeting the debenture interest, preference dividend, &c., it is proposed to pay a final ordinary dividend of 10d. per share, free of tax, making 1s. 2½d., tax-free for the year (against 1s.

per share for 1927). A balance of £11,020 remains to be carried forward. The meeting was to be held yesterday (Thursday).

French Companies.

The *Compagnie Générale d'Electricité* states that the works were fully occupied in 1928, but the profits were not satisfactory owing to low sale prices due to competition. The production of electricity by the subsidiary companies largely increased and the "participations" were augmented. As mentioned in a previous issue a dividend at the rate of 17 per cent. is being paid out of net profits of 21 million fr., as compared with 14 per cent. in the previous financial period of 18 months. At the recent annual meeting the chairman directed attention to the growing danger of American influence in the economy of Europe and to the necessity, in order to avert this danger, for bringing about a cartel of European industry in a national and international framework, similar to those which had been formed in individual branches as, for instance, steel, aluminium, &c.

The *Compagnie Radio-Maritime* reports a net surplus of 2,991,000 fr., including the balance brought forward, the dividend being 25 per cent.

The *Société des Appareils et Compteurs Garnier*, after providing for depreciation, reports net profits of 719,000 fr. for 1928. The dividend is at the rate of 96 fr. per old share and 83.50 fr. per new share.

The *Compagnie Générale de T.S.F.* states that the net profits increased from 9,209,000 fr. in 1927 to 9,828,000 fr. last year. The dividend is 50 fr. on the "A" and "B" shares, as against 25 fr. and 50 fr. respectively for 1927.

The *Société d'Electrochimie et d'Aciéries d'Usine* reports net profits of 15.7 million fr. for 1928, as compared with 12.8 millions in the previous year. The dividend is increased from 12 per cent. to 14 per cent.

The *Compagnie Française pour l'Exploitation des Procédés Thomson-Houston* reports net profits of 22,141,000 fr. for 1928, against 17,883,000 fr. in the previous year. Including the amount brought forward, the sum available for disposal is 26,621,000 fr., and the dividend is maintained at 6 per cent. on the capital of 300,000,000 fr., leaving 5,070,000 fr. to be carried forward.

The *Compagnie des Lampes*, which belongs to the French Thomson-Houston group, records net profits of 19,106,000 fr. for 1928, as compared with 18,105,000 fr. in 1927, the dividend remaining at 14 per cent. It is proposed to increase the share capital from 60,000,000 to 70,000,000 fr., and most of the new shares will be applied to the purchase of two small lamp factories, the balance being offered to the existing shareholders.

Belgian Companies.

The *Société Générale Belge d'Entreprises Electriques* reports that the electricity undertakings continued to develop in 1928, and the number of customers at home and abroad further increased. The net profits amounted to 10,898,000 fr., permitting of the payment of a dividend of 70 fr. per share.

The *Société d'Electricité et de Mécanique* (*Thomson-Houston and Carels systems*) states that on the whole 1928 was a favourable year, as the various departments were in full activity. The net profits were 8,250,000 fr., but in order to strengthen the financial situation it is not proposed to make any distribution, almost all the profits being allocated to the general redemption fund.

The *Société des Ateliers de Constructions Electriques de Charleroi* states that the industry was prosperous during 1928, and the company's works were fully occupied. Despite the increase in Customs tariffs the orders received for export were substantially higher. All the efforts of the directors were devoted to the development of sales abroad. The net profits last year amounted to 12,815,000 fr., and the dividend is at the rate of 35 fr. per share.

Swiss Companies.

The *Société Suisse d'Industrie Electrique* reports an increase in the net profits from 2,919,000 fr. in 1927 to 3,384,000 fr. last year. The dividend is maintained at 8 per cent. on the share capital of 30,000,000 fr.

The *Swiss-American Electricity Co.*, Zurich, after placing 1,000,000 fr. to reserve, records net profits of 7,904,000 fr. for 1928-29, which is the first year of activity. The preference shares are to receive a dividend of $6, the "A" shares 6 per cent., and the "B" shares 5 fr. per share.

The *South American Electricity Co.*, Zurich, reports profits of 2,377,000 fr. for the year ended April 30th, 1929, as compared with 3,155,000 fr. in the previous financial period of 17 months. It is proposed to maintain the dividend at 7 per cent.

German Companies.

The *C. Lorenz Co.*, Berlin, intends to maintain the rate of dividend for 1928 at 6 per cent.

The *Rhenish Electricity Co.*, Mannheim, is paying a dividend of 9 per cent. out of net profits of 1,385,000 marks in 1928, as compared with the same rate and profits of 1,403,000 marks in 1927.

The *Accumulator Works Co.*, Berlin, proposes to pay a dividend of 8 per cent. out of net profits of 2,190,000 marks in 1928.

The *Transradio Company for Wireless Overseas Traffic*, Berlin, reports considerable progress for 1928. The accounts show a net profit of 1,391,000 marks, against 1,387,000 marks in 1927; the dividend remains at 8 per cent.

The *Land & Sea Cable Works Co.*, Cologne-Nippes, states that orders were satisfactory in 1928, but it was impossible to raise sale prices to meet the increased costs of production. Out of the net profits of 334,000 marks (337,000 marks in 1927) it is intended to again pay a dividend of 10 per cent.

The *Elektra Company*, Dresden, which is mainly a holding company, reports that the net profits in 1928 amounted to 1.92 million marks, as against 1.91 millions in the previous year; the dividend remains at 12 per cent.

The *Electricity Company* (*late Schuckert*), Nuremburg, has raised its dividend from 8 per cent. to 11 per cent. for 1928-29 as a result of the further progress of the undertakings in which the company is interested and the rationalisation measures carried out in the case of the parent and subsidiary companies.

Stocks and Shares.

MONDAY EVENING.

THE General Election has almost ceased to be a factor of any immediate consequence in the Stock Exchange markets. Prices recovered without difficulty from the depression into which they were at first plunged by the early results showing the Labour Party to be in such force. With the new Cabinet constituted, surprise and pleasure are expressed at the Labour Party being able to put so workmanlike a body into the field of government. Those prices which, earlier on, had been unfavourably affected by the fear of a considerable Socialist majority were soon restored to their former levels. The only dull spot in the markets with which we deal is that concerned with cable stock and shares, and with the shares in the Marconi Company. Quiet discussion is aroused concerning the probable policy of the new Government in regard to the Safeguarding Acts. Smethwick Corporation expresses grave concern at the transfer of the Shropshire, Worcestershire and Staffordshire Electric Power Company to one that is "controlled by a foreign undertaking and supported by foreign capital."

Cables and Wireless Weaker.

In explanation of the weakness that has attacked Eastern Telegraph ordinary stock and the shares of the associated companies, Eastern Extension, Western Telegraph and Globe, attention is directed to the somewhat pessimistic prophecy in regard to dividends that was indulged by Mr. J. C. Denison-Pender, at the meetings of the cable companies at the end of last month, though it may be doubted whether the chairman intended to convey more than an impression of conservatism to those who had been expecting the full 7½ per cent. to be paid straight away on the "A" shares of the merger company. Moreover, the news that the Venture Trust, Ltd., had served a writ upon the Marconi Company on behalf of the holders of £1 ordinary Marconi shares led to nervousness on the part of some of the cable stockholders, who asked whether, in the event of the injunction being granted, and the subsequent suit successful, this would mean the abandonment of the whole plan of Wireless & Cables, Ltd. The action is to be heard on the same day as this paper appears. In the meantime, Marconi shares are ¼ down at 76s. 3d. The £1 shares reacted to 4¼, and the 7 per cent. cumulative participating preference gave way to the same price. Eastern Telegraph ordinary stock has fallen 5 points to 265; Eastern Extension and Westerns are both 10s. lower at 26½. Burndept Wireless have hardened a shade to 4s. 7½d. for the 5s. fully-paid shares. The accounts are expected to be made public at an early date, and, according to advance anticipation, they are likely to make a good showing. Canadian Marconi improved to 33s. 9d.

Brush Bonus.

The Brush Electrical Engineering Company has circularised its shareholders offering them their individual proportion of the sum of £4,764 standing to the credit of undivided profits account, and representing the shareholders' proportion of the surplus under the co-partnership scheme for the last three years. This is in accordance with a resolution passed at the last meeting, which resolution further provided that each shareholder should be at liberty, at his option, either to take the proportion of distribution in cash, or to require that it should be applied in payment of ordinary shares at par, to be converted into ordinary stock of the company. The result is that each holder of 100 shares will receive £1 5s., less tax, at 4s. in the £, which he can either sell in the market, or have converted into stock. The price of the shares is unchanged at 27s. 6d. Siemens have been a feature of strength with a further advance of 5s. to 32s. 6d. The reason for this is the statement, made a few weeks back, to the effect that closer co-operation between the British company and two or three of the other Siemens companies operating abroad is in contemplation. Siemens 10 per cent. preference have advanced to 32s. 3d.

Manufacturing and Equipment.

Associated Electrical Industries ordinary shares and General Electrics have been up to 53s. 6d., but reverted to the previous figure of 52s. 6d. Callenders are a good spot at 87s. 6d., which, although showing no change, maintained the rise which took place a week or two ago. The company's report made its appearance a fortnight ago, and details were furnished therein of the new issue to which proprietors are entitled to apply, this being one new share for nothing, in respect of every five shares held. Sir Tom Callender, the deputy chairman and managing director, received a very sincere and cordial appreciation of his work at the meeting when these resolutions were carried. Henleys have risen 3/16 to 6 5/16. Half-a-crown was lost by British Insulated at 3¾. In the engineering division, Babcock & Wilcox declined to 63s. 9d. Vickers went to half-a-guinea, then recovered to 10s. 9d. An active business in Ever-Ready shares left the price unchanged at 23s. 6d. Telephone Manufacturing are dull at 5s. 9d.

Telegraph and Telephone.

Japan has arrived at an agreement with the Great Northern Telegraph over the account that was under discussion for more than a year, and has paid £143.000 to the company. This was announced at the general meeting held recently in Copenhagen. The money comes in, of course, as an extraordinary receipt, but the shareholders will feel none the less satisfied on that account. Anglo-American Telegraphs keep steady. International Telephone and Telegraph is about 250; American Telephone and Telegraph rallied to 215. The Interstate Commerce Committee of the American Senate listened last week to an extremely interesting exposition of the International Company's ambitions in regard to the employment, for a world-wide communication system, of every known method of transmitting information. The American Telephone and Telegraph Company contemplates a transatlantic telephone to supplement the three radio channels now in use. Business men, it is common knowledge in the city, are beginning to realise the value of the telephone service between this country and the United States. When the cost is reduced, there can be no doubt as to the rapid extension of the public's appreciation on this side of the Atlantic.

B.E.T. and Mr. Garcke.

British Electric Traction deferred stock has put on another 150 points, as it did in the previous week. The price is 1350 middle, and stock has changed hands up to 1375. Salient figures from the report were given on page 1022 of last week's ELECTRICAL REVIEW. Mr. Emil Garcke, who founded the B.E.T. in 1896, is retiring from all active participation in the business, and, in recognition of his services, Mr. Garcke is to be allowed to subscribe for 5,000 British Electric Traction deferred shares at their par value of £1. Translated into stock, at the nominal market price of 1350, this is equivalent to making a present to Mr. Garcke of £67,500, less the £5,000 he will pay for the shares, assuming, of course, that he could sell at the quotation mentioned. But prospects point to a yet higher value being reached.

Electricity Supply Shares in Demand.

Noticeable activity obtains in the shares of provincial electricity supply companies. For a day or two after the General Election results appeared there was a distinct halt. Shareholders began to ask whether the American buying interests would change their acquisitive policy in view of the advent to power of a Labour Party known to look darkly upon anti-Socialist finance. But no sellers appeared. Prices therefore remained hard. Renewed buying of provincial shares set in. Clyde Valleys are 2s. up to 35s. 9d. The new shares show a small gain at 15s. 6d. premium. Midland Counties have risen to 34s., Midland Electric Power to 37s. 6d., Richmonds to 46s. 9d., and Yorkshire Electrics at 36s. 6d. are a florin better. Newcastle-on-Tyne moved up to 27s. The new Lancashires at 28s. 3d. are somewhat sluggish, but can be expected to go better when all the stags are out. Northamptons put on another 1s., to 47s. Of the London shares, County ordinary strengthened to 55s. 6d., and Londons to 28s. A gain of 9d. in Whitehall Electric 7½ per cent. preference has raised the price to 24s. 9d.

Home and Foreign Traction.

Central London ordinary assented stock is a point higher at 73; otherwise the Underground group shows dullness. Metropolitan consolidated is ¼ down at 60½. Underground incomes have gone back to 111, and the shares to 23s. The United States is tackling seriously the matter of conserving its oil resources. President Hoover convened a conference for this (Monday) afternoon, to talk over the matter. Restriction of oil might lead to higher prices for petrol, and contraction of L.G.O.C. profits. The other London traction issues are dull, London and Suburban preference at 12s., and London United Tramway preference at 7s. being each 6d. down. Brazilian Tractions rose 2 points to 56 on the lately-issued report. Improvements in the Mexican issues include 2 dollars in the Tramways 5 per cent. bonds, and in the Power and Light preferred shares, both advancing to 74½.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1927.	1928.	Price June 10 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¾	26/6	—	5 5 8
City of London	1		10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1		6	23/-	—	5 4 4
Clyde Valley	1		8	35/9	+2/-	... ...
County of London	1	7½	10	55/6	+1/-	3 12 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	56/3	—	3 13
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	9	28/-	+6d.	5 0 0
Metropolitan	1	9	9	47/6	—	3 16 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	34/-	+1/-	3 16 6
Mid. Elec. Power	1	15	8	37/6	+6d.	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	27/-	+9d.	4 9 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	2	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/9	+9d.	6 1 2
Yorkshire Elec.	1	8	8	36/6	+2/-	4 7 9

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	73	+1	5 9 7
Metropolitan	,	8	8½	60½	—½	5 15 8
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/-	—6d.	6 1 9
do. do. Income ...	Bonds	6	6	111	—1	5 7 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2⅛	—	6 1 1
Eastern Extension	10	10	10	26½	—½	*3 15 6
Eastern Tel. Ord.	Stock	10	10	265	—5	*3 15 6
Globe Tel. and T. Ord.	10	10	10	27½	—½	*3 12 0
do. do. Pref.	10	6	6	11⅛	—	5 5 6
Great Northern Tel.	10	20	—	81½xd	—	... ...
Indo-European	25	10	10	50½	—	*4 19 0
Marconi	10/-	10	20	76/3	—¼	... ...
Marconi-Marine	1	12½	15	3⅛	—	4 16 0
Oriental Telephone Ord.	1	12	12	3	—	... ...
Western Telegraph	10	10	10	26½	—½	3 15 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅝	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3⅝	—	8 5 6
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	5	5	1350	+150	... ...
do. do. Pref. Ord.	,,	8	8	180½	—	6 3 7
Brazil Traction	100	7	8	56	+2½	3 11 5
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	94	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—6d.	... ...
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams, 5% Bonds	—	5	5	74½	+2	6 14 3
Mexican Light Common	100	Nil	Nil	7½	—	... ...
do. 7% Pref.	100	7	7	74½	+2	9 8 0
do. 1st Bonds	—	5	5	75½	—	6 12 5
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	52/6	—	2 5 6
Babcock & Wilcox	1	13	15	63/9	—9d.	*4 14 4
British Aluminium Ord.	1	10	10	51/3	—	*3 18 9
British Elec. Transformer Pref. ...	1	7	7	13/9	—	9 6 8
British Insulated Ord.	1	15	15	3⅝	—	4 2 8
Brush Ord.	1	10	10	27/6xd	—	7 5 6
Callenders	1	15	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1⅛	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	6½	18/9	—	5 17 4
Enfield Cable Ord.	1	20	20	4½	—	4 14 1
English Electric	1	Nil	Nil	6/8	—	... ...
do. do. Pref.	1	3	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6¼	6¼	22/6	—	5 10 8
do. Ord.	1	7½	10	38	—	3 10 4
Henley...	1	25	25	6⅞	+⅛	3 19 6
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	36/3xd	—	5 10 4
Siemens Ord.	1	7½	7½	32/6	+5/-	4 12 4
Telegraph Construction	12	10	10	24½	—	*4 19 3

* Dividends paid free of Income Tax.

Swedish Electrical Developments.

Manufacturing and Foreign Trade.

INTERESTING details are given in *Swedish Export* of electrical developments in Sweden during 1928.

Swedish manufacturers of electrical goods, in common with those of other countries, have had a larger turnover than in preceding years, but the financial result has hardly improved in a corresponding degree, which must be attributed to the extremely severe competition.

Several fresh investments of capital, as well as certain mergers of old firms, have taken place. The L. M. Ericsson Telephone Co., which had earlier acquired the control of the Svenska Radio A/B, the representatives of the Marconi interests in Sweden, is now also the owner of the large Sieverts Cable Works. Partly on this account the capital was raised by about 20,000,000 kronor. A still larger issue of new shares was made by Electrolux, which called for fresh capital of 48,000,000 kronor. The Jungner Accumulator Co. has also raised its capital to over 5,000,000 kronor.

During the year the Asea Company extended its organisation abroad by opening up offices in Bombay, Calcutta and Melbourne. The Russian business has been organised under the designation, the Swedish Electro-Concession Asea in U.S.S.R. The aggregate exports of the company have increased considerably, and this applies to all the products subject to export.

Messrs. Luth & Rosén are now devoting themselves almost exclusively to geared motors and telpher cars, which are now enjoying a good demand, both in Sweden and abroad. A number of large convertors have, however, also been delivered.

There has been a good demand for the specialities of Elektromekano, of Hälsingborg, which include lighting generators for trains, squirrel-cage motors, convertors, &c., as well as for its general line of generators and motors. The Asea and Elektromekano have delivered 200 motors installed in the American liner *Kungsholm*.

The Elektrolux concern has during 1928 completed its programme for organising the manufacturing of its vacuum cleaners, refrigerators and floor polishers, and it now possesses factories with a large output in England, France and Germany, in addition to the Swedish establishment. It has also commenced manufacturing washing machines, but this apparatus has not so far attracted so much attention as the other products, at any rate, in Europe.

The Elektriska A.B. Volta participated in the export of vacuum cleaners, England especially being a good market.

While Sweden is importing electric wire and cable, as well as wiring material in general, to a very great extent, the export of the Swedish cable works' products is growing steadily. The export of insulated wire and cables in 1928 was valued at 4,300,000 kronor, as compared with 3,200,000 in 1927. There has also been great activity in the storage battery, electric heating appliance, and radio branches of the industry.

The Swedish imports and exports of electrical machinery, apparatus and goods during the past two years are shown (by weight) in the appended tables.

IMPORTS.	1927 kg.	1928 kg.	Inc. or dec. kg.
Electrotechnical porcelain	1,319,900	1,537,373	+ 217,473
Electric locomotives, tramcars and hoists	1,561,204	750,507	— 810,697
Motors, generators, transformers	930,856	1,267,618	+ 336,762
Vacuum cleaners	31 884	36 864	+ 4,980
Incandescent lamps	159,086	179,375	+ 20,289
Carbon for elecl. purposes ...	2,181,846	2,426,391	+ 244,546
Electric "strong-current" instruments	672,903	724,727	+ 51,824
Telephone and telegraph apparatus	16,666	5,647	— 11,019
Wireless material	249,165	351,581	+ 102 416
Totals	7,123 510	7,280,083	+ 56,573
EXPORTS.			
Electrotechnical porcelain	78,677	76,403	— 2,274
Electric locomotives, tramcars and hoists	975,350	968,971	— 6,379
Motors, generators and transformers	10,895,049	13,066,291	+2,171,242
Vacuum cleaners	1,126,306	1,183,609	+ 57,303
Incandescent lamps	8,608	12,091	+ 3,483
Carbon for elecl. purposes ...	445,761	688.411	+ 242,650
Electric "strong current" instruments	997 086	1,103,882	+ 106,796
Telephone and telegraph apparatus	706,488	859,588	+ 153,100
Wireless material	104,286	101,335	— 2,951
Totals	15,337,611	18,060.581	+2,722,970

Electrical Progress in Poland.

Large Developments in Hand.

THE recently issued report for 1928 of the Société Force et Lumière of Brussels and Warsaw contains a lengthy reference to the electrical developments which are taking place in Poland. In 1923-24 the company entered into an agreement with the Power and Traction Finance Co. (Poland), Ltd., London, to finance, under the British Trade Facilities Act, the establishment of the various undertakings under Force et Lumière control.

According to the Force et Lumière report the output of electricity in Poland in 1927 amounted to 1,742 million kWh, as compared with 1,441 million kWh in 1926. It is estimated that Poland can consume 5,000 million kWh per annum, so that there is still ample room for further development in the country. More than half of the towns and cities of Poland are still not provided with electric lighting. The best equipped districts are those of Warsaw, Lodz, Pomerania, Lublin, Kielce, Wilna, and Silesia, which comprise the most populous sections.

Hydro-electric power is relatively undeveloped, most of the electricity being generated in steam stations. Many of the stations are situated in the coal-mining district near the mines and steel works which are the main consumers. The possibility of electrifying the oil-producing area of Boryslaw has been investigated, and activities in that direction have already been commenced. It is expected that the realisation of the scheme will result in large savings in the quantity of petroleum and natural gas now consumed for power purposes by the various mines. The reserve hydro-electric power in the district of Pomerania and in the region of the Carpathian Mountains is estimated at 1,000,000 kW. The greater number of hydro-electric stations are at present located in Pomerania, where the flow of the rivers is particularly favourable.

The consumption *per capita* of electricity in Poland at present averages only 26 kWh per annum, ranging from 300 kWh in the industrial region of Upper Silesia to 2 kWh in the eastern provinces bordering Russia. Many improvements have been made in the electrification of the country during the last few years. Among the works recently undertaken or effected is the supply of electricity to the port of Gdynia from the hydro-electric station at Grodek, Pomerania. All port installations at Gdynia will be electrified, and a contract for the supply of electricity has been signed recently between the Polish Ministry of Industry and Commerce and the Grodek Co., of Torun. At present Gdynia is supplied from a small hydro-electric station at Rutki. The Grodek Co. has undertaken to construct an overhead 60,000-V transmission line from Grodek to Gdynia, a distance of about 84 miles. At the same time a new power station will be constructed by the Grodek Co. at Zur, on the Czarnawoda River in Pomerania, with a capacity of 10,000 h.p. Electrification works undertaken by the Verdatok concern were recently completed in the industrial district of Jaslo-Krosno. Rapid progress has also been made in electrifying the Silesian Basin. The electrification of one of the most industrialised districts of Poland, Radom-Kielce, is of great interest to the country, and is being effected by the formation of a Union of central electric power stations of the Radom-Kielce district. The system of the Union will in the future be connected with the State h.p. network, the construction of which is projected, and will cover the district of Radom-Kielce. The annual production of the Union is estimated at approximately 60,000,000 kW.

The initiative of the coal mines of the districts of Dombrowa and Cracow resulted in the establishment of a union of central electrical power stations of the Dombrowa-Cracow Basin, known under the name of Zetkop. This organisation is planning the installation of a distribution system which will at first cover the territory of the Dombrowa-Cracow district, and later be extended to Olkisz, Czestochowa, Lodz and Warsaw.

The Electrification Union of Chelmno-Swiecie-Torun has undertaken the extension of its system to all districts in Pomerania. It planned to construct during 1928 over 50 miles of new h.p. distribution lines. After the completion of this system 22 communes in the district of Torun are to be electrified, 20 in the district of Swiecie, and 10 in Chelmno.

At present there are in Poland three organisations engaged in electrical research and industry, of which the most important is the Association of Polish Electrical Engineers, established for the purpose of propagating electrotechnical science, drafting regulations, and revising the terminology. Technical interests of electrical undertakings are being watched by the Association of Polish Electrical Stations, while a third society, the Association of Electrical Undertakings, serves the purpose of furthering Polish electrotechnical industry and trade.

Estonian Foreign Electrical Trade.

During March last electrical machines, apparatus and implements valued at 98,447 kr. (£5,400) were imported into Estonia. Exports of the same class had a value of 17,475 kr. (£950).

The I.M.E.A. Convention—III.

A Report of the Proceedings and Social Functions at the Annual Convention at Torquay.

TORQUAY may now be added to the number of towns which have provided a store of pleasing memories for those privileged to attend the annual Conventions of the I.M.E.A. One came away with the impression of a most successful week from both

Back: Mr. C. W. Salt, Mr. W. C. Bexon, Mr. J. H. Parker, Mr. H. Wilson.
Front: Mr. J. W. Burr, Mr. A. C. Cramb, Mr. A. P. MacAlister.

Fig. 1.—Six Chief Electrical Engineers with their Former Chief.

the social and more serious aspects. The only flaw was the wet weather on Wednesday, which made it necessary to cancel the garden party. This disappointment had some compensation to engineers in that it permitted a fuller discussion of the paper on heavy-oil engines; also the Corporation kindly invited members to attend a concert, followed by tea, in Prince's Gardens. The same spell of rain was responsible for the absence of an official photograph this year, but an attempt has been made by us to fill the gap to a small extent with private views of members going about their business.

Though one speaks of "the more serious aspect" of the Convention, that is not to accord to it a greater importance. It is to the social side of these Conventions that one looks to provide the atmosphere of good feeling which promotes good understanding. If members happened to differ in their views, they differed; but they could feel (and later remember) that those with whom they disagreed were reasonable and likeable personalities, and not machines for uttering perverse opinions.

The discussions on the papers were well developed and would, no doubt, have been lengthy had time permitted. The manner in which Mr. Nichols Moore presided enabled as many as possible of the members who could constructively criticise the papers to take part in the proceedings. From general report, confirmed by the charming tribute paid to Mrs. Nichols Moore by Mr. Chattock at the annual dinner, it may be inferred that the conduct of the E.A.W. meetings was no less able.

It is perhaps fitting to mention here (if only in parenthesis) that the presence of so many members of the Electrical Association for Women at Torquay was one of the most pleasing features of the week—not only as a social asset, but also as an indication of the important part which women are destined to play in the development of electricity. We propose to deal more fully next week with the subject, including the lecture given by Miss Partridge on Thursday last week. Meanwhile, we may note, as a matter of interest, that a new branch of the E.A.W. was subsequently formed at Plymouth with Lady Astor as its first President.

The paper on tariffs provided the fullest, and that on legal problems the most entertaining, discussion. A few of the salient points may be noted here. Alderman Walker's underlying principle with regard to Whitley Council awards is that wages and conditions should be of such a character as to attract the best men to the electricity industry, due regard being paid to wages cost in private plant. During the discussion of legal problems, it was authoritatively stated that while no commercial method at present exists for preventing the emission of sulphurous-acid fumes from power stations, a solution of the difficulties due to grit deposition will certainly be found in the early future. The discussion on heavy-oil engines elicited the fact that in Germany, while the practice is to carry the base load on steam stations, oil engines are often installed to maintain voltage at peak at the end of long overhead feeders. Another view was expressed that as capital charges for peak-load plant are from ten to fifteen times the cost of fuel, the higher capital cost of the oil engine would severely limit its utility, unless super-charged engines could be designed for a much greater number of revolutions.

Figs. 2, 3 and 4.—Mr. J. W. Simpson, the President, Mr. Cramb and Councillor Griffiths.

The paper on tariffs provided an opportunity for emphasising the soundness of the principles enunciated by Dr. John Hopkinson 37 years ago. There was agree-

ment among those who joined in the discussion, with but one dissentient voice, as to the superiority of the two-part tariff over the flat rate. It was also submitted that the primary charge should be as high as might be necessary to enable a very low secondary charge to be quoted.

The social festivities reached their climax with the annual dinner on Thursday, at which some 300 persons were present. Sir John Snell, in proposing the toast of the I.M.E.A., congratulated the President on the vision shown in his address. He was in sympathy with his views, and the next big task of the Commissioners would be the co-ordination of distribution. His listeners were disturbed by the doubt he expressed as to his own strength for the purpose, and could only hope that complete restoration to health would negative the implication. He praised the enterprise of Torquay Corporation and its engineer in extending the local network into the hinterland, and referred to the Ayrshire Joint Board as an example of successful co-operative action.

The most striking feature of the speech was a reference to the urgent need for better financial support of the Electrical Research Association by the electricity supply industry. This is dealt with more fully in our leading article. Sir John, in his concluding remarks, referred to the consistent courtesy of the Honorary Secretary of the Association, Mr. A. C. Cramb, upon whom has fallen the brunt of organising so many Conventions. Other speakers were, in chronological order: the President, Ald. E. Huntsman, the Mayors of Newport and Torquay, Mr. R. A. Chattock and Mr. Frank Hodges, to whose speeches a later reference will be made.

During the dinner the sea-front was brilliantly illuminated by the Corporation, the work being carried out under the direction of Mr. H. F. G. Woods, the borough electrical engineer. Many other lighting effects due to the enterprise of well-known electrical firms gave the town a gala appearance at night. Among the most noticeable was the flood-lighting of the ladies' bathing beach from the parapet outside the Vitaglass Room of the Medical Baths. The contrast of the vivid green verdure on the cliffs with the sombre darkness of the sea received much favourable comment from the dancers. Other good flood-lighting schemes included the Town Hall, Pavilion, Royal Terrace Gardens and the Grand Hotel. A particularly good example of shop-window lighting was that displayed by Messrs. Bobby and Co., Ltd. In the harbour a curious craft advertised a well-known piece of electrical apparatus. Outlined with lamps by night and gay with bunting by day it attracted the attention of all comers and added to the gaiety of the scene. These efforts were supplemented by H.M. aircraft-carrier *Furious* lying in Torbay, the outlines of the huge vessel being well defined by lamps on Monday.

The hospitality of Torquay has been manifest in so many ways that her claim to be " the guest-town of the United Kingdom " does not seem too ambitious. The ever-present sense of welcome was heightened by the personal interest shown in the proceedings of the Convention by the Mayor in his dual personality of " engineer and lawyer."

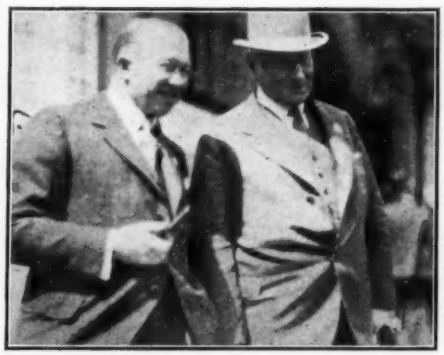
Taken altogether, the I.M.E.A. Secretary, Mr. J. W. Simpson, is to be congratulated on the outcome of his first Convention.

Whitleyism in the Electricity Supply Industry.
Discussion on Ald. W. Walker's Paper.

Mr. A. NICHOLS MOORE, president, in calling upon Councillor W. GRIFFITHS (Mayor of Newport, Mon.) to open the discussion, said he did so, not because he came from Newport, but because for many years he had been on the executive of the National Union of Railwaymen, and had been a member of the negotiating Committee which ultimately settled conditions on the railways on the basis of Whitleyism. The president added that Councillor Griffiths was at present a working railwayman on the footplate of a G.W.R. locomotive, and therefore he would discuss the paper from the employés' point of view.

Councillor GRIFFITHS said there were two outstanding features of the adoption of the Whitley Council system on the railways. One was that it saved a great deal of managerial time which was formerly taken up in dealing with wages and conditions in relation to numerous and separate applications, and the other was that it had been possible, through the medium of the Whitley Councils, to more or less standardise wages and conditions, at any rate so far as the areas were concerned, and that had removed the cause of a very great deal of dissatisfaction. As a result of all that there was a far more satisfied body of workers on the railways, and consequently a more efficient service. Referring to the statement in the paper that very often extravagant and irresponsible applications are made for improved conditions, Councillor Griffiths remarked that the workers could not get out of an industry more than they put into it, nor more than the industry could bear. At the same time, if the management desired to get the utmost out of the employés it was only natural that the employés should expect the management to do its utmost on its part. The point it was necessary to bring home to the workers was that the more they put into the industry the better opportunities there would be for them to share in the results of their activities. One of the best ways to get the utmost out of the employés was to give them a share in the management and control. That might be regarded by some people as a revolutionary proposal, but he claimed it was necessary to take the men into the confidence of the management, and invite them to share the responsibilities. Development along those lines would be productive of much good. On the railways there was a system of local councils, and those local councils met the management periodically and discussed questions affecting the welfare of the industry. If some such machinery could be introduced into the electricity supply industry, so that the practical knowledge of the men could be made use of in developing and controlling the industry, a great deal of good would inevitably follow; there would then not be the extravagant demands that were so often made. He therefore suggested that the electricity supply industry should go a stage farther than the Whitley Council and develop along the lines he had suggested, because that would build up greater confidence between the employés and the management, and would be not only to the benefit of the particular industry, but also for the country as a whole.

Alderman E. HUNTSMAN (chairman, Nottingham Electricity Committee), whilst suggesting that the Whitley Councils in the electricity supply industry had achieved the objects laid down by the author, deprecated the implication in the paper that an expert should be appointed to deal with the case for the employers when negotiations had to be carried on. It was obvious that when matters were discussed between the



Figs. 5, 6 and 7.—Four well-known Members.

employers and the employés there should be a complete knowledge of all the facts on both sides, but for the case for the management to be dealt with by some expert would inevitably create suspicion, because, speaking as a lawyer, he knew the tendency of such experts was to desire to win their case rather than to discuss the particular matter in the amicable and friendly manner so essential in such negotiations. As to the suggestion in the paper that the areas of Whitley Councils should coincide with the areas set up by the Electricity Commissioners, he rather felt that with the establishment of Whitley Councils, with their present areas, there had grown up a sort of local patriotism, and during the whole of his experience there had not been one discourteous word said on one side or the other. In such circumstances he thought they should hesitate before sacrificing such a state of affairs, and go over to a system of larger areas, as suggested in the paper.

Alderman G. CROOT (chairman, West Ham Electricity Committee) said he had been on the No. 10 District Council for 10 years as a representative of the management side, although for 40 years he had been associated with a certain social and political movement which had for its object the improvement of the conditions of the workers. However, he claimed he had been able to do justice to the managerial side without sacrificing anything so far as the workers were concerned, because he had always kept his personal opinions to himself. (Loud laughter.) Speaking, however, from the workers' point of view, he suggested to employers that it was to their interest that their employés should join their trade unions, because it might easily happen that if there were a large number of non-unionists in a works they would not have direct representation on a Whitley Council, and might cause far more dissension than the trade unionists. He agreed it was not the business of the management to insist that all their men should join the union, but it would undoubtedly be to the general advantage if they did. As regarded the ability of an industry to pay higher wages, he contended that employers should not use the argument put forward in the paper that other industries were not paying such high wages as a reason for not improving the conditions of their own men. If an industry could afford to pay higher wages it should do so, irrespective of the conditions in other industries. As to the complaint in the paper that trade unions made repeated applications for better conditions, that was what a trade union was for.

Alderman A. SENINGTON (Bristol) referred to trouble that existed in the No. 6—Bristol—area with regard to the constitution of the District Council and complained that the democratic nature of the District Councils was not being maintained because duly appointed trade union representatives were not being allowed to serve on that particular Council.

Councillor T. SNOWDEN (chairman, Bingley Electricity Committee) said it might seem a little paradoxical that he was an employer and a member of a trade union, but he was practising that spirit of sweet reasonableness which would have to be made manifest very much more than it had been up to now if they were going to solve the problem of the employer and employé. Speaking with regard to the suggestion in the paper that agreements should be made compulsory, he said he was distinctly opposed to that because he believed it was far better to approach employer and employé on the lines of equity and justice. So far as the employés were concerned it was a paying proposition not to treat them as hewers of wood and drawers of water, but as human units in the industry. Only in that way was it possible to remove that atmosphere of suspicion and distrust that had existed for so long and had hindered industrial prosperity in this country. The workmen must be convinced that they had a duty to perform if they were to participate in the results, and that progress would not be made by strikes and lockouts. In the past the employer had been more to blame than the workmen, however, and if an endeavour was made to work on mutual lines there would be no need to talk of making compulsory agreements. He did not believe trade unions would abandon the strike weapon, but at the same time he was convinced that mutual discussions on the lines of Whitley Councils would enable a happy medium to be arrived at and make both sides appreciate that they were members of a general community in the industry.

Alderman W. WALKER, replying to the discussion, said the machinery was already available for setting up works councils in the industry, such as were indicated by the Mayor of Newport. There was the constitution to enable that to be done by agreement between employers and the workers, and therefore Newport had its opportunity if it desired to take advantage of it. He had been associated with works councils on the Manchester Corporation which discussed with the management questions relating to the conduct of the undertaking, and they had been exceedingly useful. There was no intention of suggesting in the paper, as Alderman Huntsman had inferred, that an expert should be appointed to argue the case for the employers when matters of dispute arose. What he meant was that there should be someone in a permanent position who would prepare facts and figures for the use of the members of the Whitley Council on the management side, because it was necessary to have all the relevant facts, but it took a great deal of time for individual members of the Council to find them for themselves. The trade unions did this; they had their investigation and research departments which prepared facts and figures for the use of those who had to conduct the negotiations. As to the suggested alteration of areas, he believed that would have to be considered in time. Alderman Croot seemed to be a Dr. Jekyll and Mr. Hyde, and never seemed to know which he was at any particular moment, but there again it was possible to deal with the difficulties he had mentioned of repeated complaints by means of works councils. He was sorry Alderman Senington had brought a local squabble into the discussion. The local constitution of the Whitley Council in the Bristol area was peculiar, and there was a dispute going on which he was hoping would be settled locally. As chairman of the National Joint Committee he was advising his colleagues to keep out of the matter if it were at all possible, and let the dispute be settled locally. Mr. Snowden appeared to have misconceived what was meant by compulsory agreements. The Industrial Councils Bill was an adoptive measure and did not become operative until both sides had adopted it by a majority. Each side on the council must adopt it by a majority, and then if the Bill were adopted it would prevent decisions of importance being rendered inoperative by a small minority on a council which refused to give effect to them. There was always a minority which never wished to do the right thing, and in consequence was a source of trouble to the industry. Therefore if 98 per cent. of a council was in favour of certain action they could, by adopting the Bill, compel the other 2 per cent. to do what the majority thought right.

On the motion of Mr. J. K. BRYDGES (Eastbourne), seconded by Mr. A. J. FULLER (Fulham), a hearty vote of thanks was accorded Alderman Walker at the conclusion of the discussion.

Recent High Court Cases.

Discussion on Mr. J. H. Rothwell's paper.

In the course of his introductory remarks the author explained that since the paper was prepared, a decision had been given at Leeds which drew a clear distinction between a common-law corporation and a statutory authority. The case at Leeds had to do with the running of 'buses by the Corporation. The particular service was not authorised by an Act of Parliament, but it was not proposed to spend any of the ratepayers' money and, although certain competitors endeavoured to restrain the Corporation, the Court held that Leeds, being a common-law Corporation, could do anything which a private individual could do, provided it did not spend any money which it was not authorised by statute to spend. There were many things which a Corporation could do without calling upon the rates, or any fund, and a common-law corporation could do, in those circumstances, just what an individual could do. It did not apply to urban district councils, or rural councils, or county councils, because they were created by statute; but a municipal corporation was a common-law corporation created by charter, and therefore its powers were wider than those of an authority created by statute. That was a state of affairs that was not appreciated often enough, but the Leeds decision had made the point perfectly clear, and he hoped they would all take advantage of it.

Councillor H. K. BEALE (chairman, Birmingham Electricity Committee) said that whilst there had been no complaints from residents in the neighbourhood of the Birmingham power stations as regarded sulphur, there had been complaints with regard to nuisance from grit and dust; although the town had spent £60,000 in trying to remedy that, the effort had only been partially successful and the trouble had not been entirely cured. So far as stoker-fired furnaces were concerned, he believed the trouble had been overcome, but the pulverised fuel plant was still giving trouble from that point of view. He feared that unless the trouble was prevented the size of stations would be curtailed, or the undertakings would be put upon such terms as would seriously retard the supply of cheap electricity. Only the large stations were giving serious trouble, and only by concentrated effort of engineers and chemists would a remedy be found. He did not, of course, know what the result in the Manchester case would be, but even if there were complete immunity as a result of that decision it would not be safe to carry on as at present, because public opinion had been roused and the possibility of further legislation could not be ignored, unless a remedy could be found for what was undoubtedly a very serious nuisance. That had happened before, for instance, in the case of sparks from railway engines, and therefore engineers and chemists must seriously tackle the problem. Referring to contributions to the rates and the limitation set by the Electricity (Supply) Act, 1926, *viz.*, that after March 31st, 1930, no sum shall be paid in aid of rates from profits of a trading undertaking until the reserve fund reached 5 per cent. of the capital outlay, Councillor Beale said that was a very useful piece of legislation; he had always believed that the profits of such undertakings as electricity undertakings should be used for the purpose of giving as cheap a supply as possible. An endeavour, however, was being made by some undertakings to contribute to rates out of profits for the year ending March 31st, 1930, although, as the author had pointed out, the net profits for the year could not be ascertained until after March 31st next, when, of course, under the Act it would be illegal to make such contributions. For unscrupulous authorities, however, it was possible to do that by paying what a company would call an interim dividend. It would be possible, for instance, to make a payment in advance of March 31st next on account, although, of course, it would have to come out of the net profits. He did not suggest that that should be adopted as

a general policy in order to get round the Act, but merely to show that there was a way of doing so, although he had no doubt the Electricity Commissioners would effectually close that loop-hole.

Mr. O. TREHARNE MORGAN (town clerk, Newport, Mon.) said it was a very serious matter for an undertaking to have an injunction granted against it, as in the Manchester case, and in all such cases the undertakings ought to be allowed to continue, subject to paying for any damage caused by them. As the damage might be continuous, that would ensure that every possible step would be taken to prevent the nuisance, and he believed the difficulties would be surmounted by chemists and engineers. As an instance of what could be done, he mentioned the pumping plant put in by the Newport Electricity Committee, by the advice of the president, to avoid the nuisance caused by cooling towers. Referring to the replacement of apparatus on a change of system, Mr. Morgan suggested that the date after which no compensation could be claimed should be the date when the Council decided to make the application to the Commissioners, and not the date of the Commissioners' consent, because owing to the publicity given to discussions in Councils and also to the notices on the agendas of meetings, some people might be smart enough to put in apparatus as soon as they heard what the Council proposed to do, and in that way the protection suggested by Mr. Rothwell would be of no avail.

Mr. F. W. PURSE (engineer and manager, West Ham) remarked that, as chairman of the Law and Parliamentary Committee of the I.M.E.A. for four years, he had been brought more closely in touch with the legal side of the Association's affairs than the body of the members and, incidentally, he expressed the view that the Association did one of the best things it could possibly have done in securing Mr. Rothwell's services as honorary solicitor. One of the things brought out by the paper was the uncertainty of the law affecting electrical undertakings and the fact that, unless it was very clearly laid down what could and could not be done, there would always be difficulties. Many members had been under the impression that so long as an unauthorised undertaker obtained consent to open the roads it was all right, but it was useful for Mr. Rothwell to point out that if the road authority gave that permission it could be proceeded against. In connection with the replacement of apparatus, he felt that with the great development of automatic rectifiers many undertakings would consider a second time before embarking on the enormous expense involved in changing from d.c. to a.c. He had never seen any justification for contributions to rates out of profits, and had always held the view that the return to the ratepayers for giving security for the loans was the valuable presentation to the ratepayers by the electricity consumers of the undertaking free of debt, or almost so, because in many cases the greater proportion of the loans was repaid and the ratepayers were thus benefited to a very considerable extent. Owing to the manner in which the general legislation relating to the industry had been dealt with, a large number of undertakings had been compelled to promote Bills containing special clauses for their protection. When the 1926 Act was going through Parliament the Association thought it was a good opportunity to insert a number of general clauses, but the Ministry of Transport said that that Bill was promoted for a specific purpose, and not for the purposes of general legislation. Detailing a number of matters upon which individual local authorities had had to protect themselves, Mr. Purse mentioned the question which arose in the St. Pancras case, in which the boundary of the area of supply went through certain premises, and it was not clear in the general legislation whether the supply given by one authority could be used in the whole of such premises; that was a matter which required clear definition. Similarly, a large number of authorities had had to seek special powers authorising them to construct sub-stations and transformer chambers, yet it would have been thought that having been authorised to supply electricity they would necessarily have had the powers to construct sub-stations, &c. Then there were the by-laws relative to apparatus, wires, and fittings: under Section 6 of the Act of 1882, power was given to local authorities to make by-laws for the safety of the public, but it had been held that they did not include by-laws relating to the interior installations of premises supplied. Thus from time to time clauses had been put into private Acts giving powers to make by-laws relating to installations. He believed his own authority was the only one which had by-laws approved by the Electricity Commissioners, and therefore enforceable; unless they were enforceable they were useless. An important point in this connection was that the clause should contain the words "premises supplied or proposed to be supplied," because in the absence of such wording the position was that an installation had to be allowed to be connected and then the supply must be cut off on the ground that it did not comply with the by-laws, the point being that until the supply was actually given the premises were not supplied. Therefore, it was necessary to add the words "or proposed to be supplied." That also emphasised the necessity for arriving at some standardisation of general clauses of that nature. There were also the facts that two-part tariffs could only be arrived at by agreement with the consumer and could not be enforceable on consumers, and again the question of pre-payment meters and responsibility for the money, as pointed out in the paper. He had known slot-meter consumers to tell him that they were hard up and had taken the money out of the meter, but offered to repay it. There again there was the difficult position that if the Corporation agreed to that it would be, in the words of the lawyers, compounding a felony! Yet another matter was the use of a power supply for lighting purposes, concerning which there had been prosecutions, all of which emphasised the need for consolidating the legislation affecting the electricity supply industry and putting it upon a sound and uniform basis.

Mr. W. M. SELVEY, referring to the complicated state of electrical legislation in this country and to further possible legislation and regulations, to say nothing of the expected Factory Act and possible meticulous regulations as to terms which might be offered for the sale of electricity, said there was a striking need for the awakening of the consciousness of the whole industry; one of the principal directions in which reform would be necessary would be in the entire recasting of the whole of the electrical legislation as soon as the country had been allocated to some authority, and when the final policy as regarded distribution could be clearly realised. He therefore suggested that the legal brains connected with the industry should turn their attention to a clear codification of the whole of the Acts in one simple and understandable form. Referring to the Manchester case, he said that the evidence in the Court of First Instance was undoubtedly that the nuisance complained of was especial to those particular works. It had not occurred elsewhere in connection with similar work, and therefore there was absolutely no technique available in order to deal with the nuisance. The evidence was further that such simple steps as had been taken at very considerable expense by the Manchester Corporation had proved wholly ineffective, and had, in fact, shown that the problem was entirely outside current ideas relating to such works. As the Act authorising the construction of the power house did not authorise the supply of electricity "within an area," as defined in Section 1 of the Electric Lighting Clauses Act, 1899, and hence did not come within Clause 81 of the same Act relating to nuisance (provided this view was sound) then the Barton power station was placed on all fours with the railways, and would not be liable to an injunction so long as negligence did not occur. That, he said, was the position which electrical engineers had always desired power stations to be in, and it was the position in which the industry must ultimately put itself as long as the law allowed such a principle to be applied to any other similar public service wholly dependent on the statutes. After pointing to the fact that apparently the increase in the size of power stations was taken seriously into consideration by the Court of Appeal, and mentioning that that fact introduced one of the largest questions which the industry had yet met, Mr. Selvey urged the necessity for the establishment of some body having power to act for, and defend as a whole, the electrical industry. Such a body must obviously deal primarily with harmonising the internal conditions of its own industry. Thereafter it must be able to speak nationally to the Government, and it should be able to formulate such a codified form of legislation as should hold a true balance between itself and those other interests with which it came into contact. That premised a definite contact in their mutual interests between supply, manufacture, transmission, and distribution, which, for the sake of illustration, might be taken as represented by the I.M.E.A. and the power companies, the B.E.A.M.A., the C.M.A., and the E.C.A. That trend of affairs might not be to the liking of everybody, but he believed it was inevitable.

Mr. R. A. REAY-NADIN (town clerk, Sutton Coldfield) said that all local authorities obtained indirect aid for their rates by the intelligent development of the electricity undertaking, because wherever electricity was developed there was also development in the local area which brought with it a substantial indirect contribution to the rates. He, personally, agreed with the principle of the 1926 Act that every undertaking should have a sufficient reserve fund to develop on sound lines. With regard to the point made by the author, arising out of the Leeds case, that a local authority had no power to give permission to a private undertaking to open the roads, as the author had also indicated that a large corporation stood in the same position as a private individual, it would hardly seem that the two points supported each other.

Councillor COUSTON (chairman, Edinburgh Electricity Committee) disagreed with the view expressed in the paper that even by the signing of an agreement to that effect, a slot-meter consumer could be made responsible for the moneys in the meter. As a magistrate in a police court, he had had to deal with cases of stealing from both gas and electricity slot meters, and he doubted whether in a High Court it would be held that the tenant, once having placed his money in the meter, was any longer responsible for it, because it was placed there at the request of the electricity undertaking in order to avoid the inconvenience and expense of daily collections. That seemed to him the common-sense point of view of the matter, and police courts only used common-sense, not law! Once the money was in the meter it was the property of the electricity undertaking, and he believed the High Court would take the view that the local corporation was responsible for it then, because it took the responsibility of leaving the money in the box, the consumer having paid for what he received, or was about to receive. Therefore he suggested that that point should be looked into further.

Mr. J. H. ROTHWELL, replying to the discussion, said that

a large number of clauses were inserted in private Acts which might now be regarded as model clauses, and the time might well have arrived when they should be reprinted in pamphlet form. Such a step was the more necessary because so many corporations were finding their legislation becoming so enormous, and because a great deal of it had become obsolete, as it had been since incorporated in general Acts. This consolidation of the legislation relating to the industry was a task which would have to be undertaken. If existing clauses could be collected in the manner he had suggested it would be helpful in another way, *viz.*, there would be practical experience of them, whereas very often without that knowledge a large amount of time and expense was involved in obtaining a clause in a Bill, only to find later that it was by no means so useful as it had been supposed to be. Th refore, the clauses mentioned by Mr. Purse would be exceedingly valuable as a supplement to the paper. The whole point of the discussion was to emphasise the question of the consolidation of general legislation with regard to electricity supply, and he hoped that if steps were taken in that direction the Government of the day would find time to consider the matter. He was interested in what Mr. Reay-Nadin had said as to the difficulty of reconciling the decision in the Leeds case, and to the suggestion in the paper that a local authority could not give permission to a private company to open the roads, but the fact remained that no private individual could open the roadway on his own responsibility. Councillor Couston had been very entertaining on the question of prepayment meters, but the whole difficulty could be overcome by insurance.

The PRESIDENT, at the conclusion of the discussion, introduced Sir John Brooke, who was recently appointed an Electricity Commissioner.

Sir JOHN BROOKE, in proposing a vote of thanks to Mr. Rothwell, said it was very necessary in any legislation, and especially in legislation relating to an industry such as the electrical industry, that the clauses should be uniform throughout the country. At the same time it was not always possible to get general legislation, and it was therefore necessary from time to time to insert special clauses in private Acts of Parliament. From that point of view, therefore, the work that the Association's Law and Parliamentary Committee was doing in bringing together such special clauses must be of enormous benefit to the industry and to those who had to report on and criticise private Bills.

Alderman H. B. VORLEY (Islington) seconded the vote of thanks, which was carried unanimously.

The Heavy-Oil Engine and its Application in Electricity Supply Undertakings.

By GEOFFREY PORTER, A.M.Inst.C.E.
(*Abstract.*)

THE Diesel engine has languished under the shadow of the remarkable achievements of the designers of the steam turbine and the high-pressure water-tube boiler; moreover, the performance of the few early examples of the engine in England was not impressive, and its reliability was not of the high standard demanded by British engineers.

Apart from its employment in stations of small and medium capacity (up to about 10,000 kW in the United Kingdom and 20,000 kW abroad) and in privately-owned industrial power houses, its use on land for electrical purposes is considered mainly in connection with stand-by and sub-station uses as an adjunct to the main plant.

The chief development has occurred in ship propulsion, in a branch of engineering in which conservatism is of the most deep-rooted order. The success of the engine at sea has revived the earlier interest on land to some extent. The total power of the heavy-oil engine employed at sea, in the form of propelling machinery, exceeds four million horse power in power ratings up to about 10,000 b.h.p. in individual units. The recent interesting decision to equip the new White Star Atlantic liner with some 100,000 b.h.p. of heavy-oil engines, arranged in power station form as a group of 30 engines of about 3,000 b.h.p each to drive generating plant for the electric motor-driven propellors, is a momentous event.

On land in the United States of America there is about two million b.h.p., and in the United Kingdom about one million b.h.p. Adding a reasonable power for the use in other countries throughout the world, an estimate of about six million total b.h.p. in use is probably not excessive.

Side by side with the increasing adoption of the heavy-oil engine has been development of the sources of natural oil. Production is now outstripping demand, and oil producers are endeavouring to consolidate a mutual policy for the restriction of supplies, ostensibly to conserve the resources of nature by the elimination of waste. The relative prices per ton of oil and coal are not entirely decisive in forming a judgment as to the superior advantages of heavy-oil engine or steam equipment in any particular instance, as the efficiency of heat utilisation affects the problem very materially. While at present the general price ratio of the two fuels is about 4.3 to 1, the introduction of the efficiency factor reduces the effective ratio to about 36 to 27, or 1.33 to 1. As in either type of equipment the fuel cost is from 45 to 50 per cent. of the total operating expense per annum, the effective relative prices have a considerable bearing upon the economics of the matter. The author is satisfied that light-grade furnace oil is a perfectly satisfactory engine fuel, subject to "digestion." Knowledge of a recent fuel-oil contract has also satisfied him that a "Diesel" oil can be obtained in large quantities at prices very much below those ordinarily quoted to the user of comparatively small amounts.

Engines.—The principal types of heavy-oil engine designed for power-station purposes are classified very roughly as follows:—

(1) The low-compression, airless-injection, "semi-Diesel" or "surface-combustion" engine; the latter description has been adopted by B.E.S.A. The majority of this class are designed as 2-stroke-cycle single-acting engines, fitted with a "hot-bulb" for storing heat to assist in firing the working fluid and to permit the formation of the mixture of oil and air for combustion.

The main objects of the design are cheapness and simplicity. In general such engines are less efficient than the high-compression types of the Diesel class and its derivatives. The use of the crankcase as one element of a scavenge pump, the low mean effective pressure, not exceeding about 40 lb./sq. in., and the class of materials utilised in construction do not permit of high thermal or commercial efficiency, nor can the class compete in terms of power rating with the designs employing higher compression pressures and brake mean pressure ratings. In general such engines do not exceed a rating of 300 b.h.p. in a 6-cylinder construction. The most recent development of this design, in which the hot bulb has almost disappeared and the cylinder head is entirely water-jacketed, approaches very closely the so-called "cold-starting" type. The retention of the crankcase for scavenging purposes necessarily limits the permissible cylinder power rating.

Engines of this class are widely used in factories and isolated situations where skilled attendance is not available, and also in very small electric power stations where capital cost is of greater importance than efficiency and operating cost. In comparison with small steam plant the efficiency is markedly good; the true "hot-bulb" engine of this class, burning a commercial grade of fuel oil, is not so efficient as the modern fully water-cooled design.

(2) The high-compression, air- or airless-injection, low- or high-speed "Diesel" engine is capable of high-power ratings in a multi-cylinder design. At present the largest engine of the kind, in which fuel is injected by air pressure and the rotational speed is 94 r.p.m., develops 15,000 b.h.p. in nine double-acting cylinders. The engine is directly coupled to a 3-phase, 6,600-volt, 50-cycle alternator. In interesting contrast are a pair of 11,700-b.h.p. 10-cylinder double-acting engines running at 215 r.p.m., each coupled directly to an 8,000-kW alternator.

The tendency to abandon the air compressor and the air-blast system of fuel injection in favour of the high-pressure fuel pump and airless (hydraulic) injection is very decided. The object of the change is to simplify operation and construction, and at the same time to cheapen first cost and improve thermo-dynamic and mechanical efficiencies.

In its modern forms the Diesel engine now includes double-acting and opposed-piston designs in addition to the older single-acting 2- and 4-stroke-cycle designs. The power rating of single-acting engines has probably reached its commercial maximum at about 400 b.h.p. per cylinder in 4-stroke-cycle examples and at about 600 b.h.p. per cylinder in the 2-stroke cycle. In either case the cylinder dimensions will be about 27 in. by 55 in., at a running speed of 100 r.p.m. and a piston speed about 900 f.p.m. The problem of the construction of cylinders above that size becomes difficult in the light of the need for efficient jet penetration, charge mixing, and heat transfer to the cooling medium; larger single-acting cylinders have been made. The double-acting type of engine permits much larger power ratings to be adopted. The problem of designing the lower combustion chamber has been solved in several ways. Most commonly the mean brake pressure below the piston is less than that used above it. Cylinder bores up to 33 in. are in commercial service. A successful, but experimental, 35-in. double-acting cylinder has been built and develops 2,000 b.h.p. on the test bed, and in time larger ratings will become commercially practicable.

The weight of engine per b.h.p. has been gradually reduced to about 1 cwt. in the case of low- and medium-speed engines; in the case of high-speed engines the lowest weight is about 15 lb. for special railway service, and some 30 to 40 lb. in the case of engines designed for driving electric generators. In the case of 4-stroke double-acting designs in service low-speed cylinders are developing 650 b.h.p.; and in that of 2-stroke-cycle engines as much as 1,600 b.h.p. (*vide* the 15,000-b.h.p. engine already mentioned). The 2-stroke-cycle, double-acting, airless-injection engine constructed by the M.A.N. Company, developing 11,700 b.h.p., is rated at 1,170 b.h.p. per cylinder.

In general the mean pressure rating of cylinders remains at a conservative value, from 65 to 70 lb./sq. in. referred to brake horse-power. Mechanical efficiency ranges from 75 to about 80 per cent. One recent double-acting 2-stroke-cycle engine, low-speed and airless injection, has achieved the remarkable mechanical efficiency of 90 per cent. In this instance, as is the case with the majority of the double-acting engines, the average mean brake pressure in 27½-in. by 47½-in. cylinders is somewhat low at 54 lb./sq. in. In this engine the rate of fuel consumption per b.h.p. per hour is 0.38 lb.

The opposed-piston type of engine, built usually as a 2-stroke cycle machine, has a successful record, and is making good headway in land service. It is, in effect, the equivalent of a double-acting engine. Up to the present the cylinder bore does not exceed 14 inches, in this country at any rate; cylinders of 19 or 20 inches are, however, under construction, and the Doxford type is shortly to be built by a British licencee in England in power ratings up to the largest for land service.

In view of their importance as land marks, particulars of the large engines mentioned in previous paragraphs are given in Table I.

TABLE I.

	15,000 B.H.P.	11,700 B.H.P.
Working cycle	2-str, 2-actg.	2-str. 2-actg
Alternator... ...	10,000 kW	8,000 kW
No. of cylinders	9	10
Cylinder bore	33.85 in.	23.62 in.
Piston stroke	59.05 in.	35.43 in.
Stroke/bore ratio ...	1.744 : 1	1.50 : 1
Revolutions per min. ...	94	215
Mean piston speed ...	926 f.p.m.	1.270 f p.m.

The 15,000-b.h.p. engine was purchased some two and a half years ago by the City of Hamburg for peak-load service in its Neuhof power station. The duty normally performed is the generating of the demand above that of the primary and secondary base loads. The set runs about 800 hours per annum, and occasionally performs base-load duty when one of the base-load sets is out of commission. The engine will start and take up one-third of the rated full load without the use of the scavenge blowers, which are in duplicate and electrically driven, a valuable feature in the event of an electrical failure in the power station circuits. The set can be run up and paralleled on the bus-bars in three minutes normally; in an emergency, when there is no warning, about six minutes is required. While the economic effect of the set is reported excellent, the reasons for installing it included specifically the great advantages to be gained by the use of a generator able to be started very quickly in any emergency without any standby charge other than the capital charge; nevertheless, the economic effect estimated to accrue in the preliminary calculations was considerable. The investigation of an improved steam plant "time factor" by the provision of a Diesel set as peak-load plant foreshadowed a net saving of the order of £25,000 per annum, and the management states that this estimate has been fully realised.

At the Neuhof station the steam plant capacity is 52,500 kW and the Diesel capacity 10,500 kW, making a total of 63,000 kW; in addition, other stations supply the system. Formerly the time factor was 2,055 hours per annum; it is now 2,430, an improvement of some 18 per cent. The increased use of the steam section of the plant at a higher rate of running plant load factor has improved the overall heat consumption (steam) by 1,000 B.th.u. per kWh. The steam plant is of excellent quality, having a performance of about 16,000 B.th.u. per kWh on test.

The management considers the addition of a further 20-30,000 kW of heavy-oil-engine generating plant would still further improve the performance by permitting better co-operation between the Neuhof and the other power stations, and would, of course, make provision for the growing peak load, bearing in mind that this year's peak tends to merge into last year's base load. In Germany the conditions of service entail the use of 50 per cent. of the installed plant capacity for peak-load purposes of short duration, while the equivalent peak-load output is no more than 5 per cent. of the total.

The thermal results of the engine as stated by Mr. M. Gercke, technical director of the M.A.N. Company, in a paper presented to the Diesel Engine Users' Association in May, 1928, are given in Table II.

TABLE II.

Gross load.	Scavenge blower.	Net load.	Fuel consumption.	Heat consumption.	Thermal efficiency.
kW.	kW.	kW.	Lb. per kWh.	B.th.u. per kWh.	Per cent.
10,405	565	9,840	0.552	9,950	34.3
10,446	572	9,874	0.550	9,940	34.3
7,941	570	7,371	0.556	10,050	33.9
5,417	556	4,861	0.587	10,620	32.1
2,561	570	1,991	0.867	15,700	21.7

The values given in the table are remarkable, even for a Diesel engine, and point to exceedingly good design. The thermal efficiency at about 95 per cent. of the gross loading is some 59 per cent. better than that of a power station steam turbo-alternator equipment with its attendant steam-raising, condensing, and auxiliary arrangements designed to capture the last B.th.u., assuming 10,000-B.th.u. coal is burnt at the overall rate of 1.5 lb. per kWh.

A pair of high-speed Diesel engines is among the first comers of the types which may eventually dominate the heavy-oil engine field. One, designed by Mr. H. F. Ricardo, F.R.S., and manufactured by Messrs. Brotherhood, of Peterborough, is an entirely new departure: it embodies sleeve-valve control of the combustion air and exhaust gases and follows light-oil engine design to some extent. The first engine of this type to be set to work in a public generating station is now in operation in Worthing and has been driving a 3-phase, 50-cycle alternator for several months in parallel with older a.c. generators. The engine is very efficient and, though a small one of 300-b.h.p./200 kW, shows a fuel consumption per kWh in daily service of 0.59 lb., or an average heat consumption of 11,500 B.th.u. per kWh at 83 per cent. (average) of the maximum rated loading. The other engine has been developed by Messrs. Mirrlees, Bickerton & Day, Ltd., of Stockport, and is a logical advance upon the customary arrangement of mechanical detail. One or two of these engines are also in power station service, and give satisfactory performance.

The method of supercharging devised by Mr. A. Büchi, who described its fundamental basis at the World Power Conference in 1928, differed widely from the ordinary system of supercharging at low air pressures occasionally employed in marine Diesel engines. By its means an engine, after undergoing inexpensive alterations of cam and valve settings, may be overloaded safely and continuously by 50 per cent. of the normal maximum rated power and by 100 per cent. for short periods. Manufacturers guarantee successful operation under overload conditions of not more than 10 per cent. for two hours in ordinary Diesel engines. Inversely, Dr. Büchi's system enables a smaller (supercharged) engine to perform the work of a larger (unsupercharged) engine, and thereby effects a reduction in first cost.

The method is to carry the exhaust gases discharged from the cylinders at about 7 or 8 lb. per sq. in. above atmosphere to a gas turbine coupled to a turbo-blower; as the gases leave the turbine at atmospheric pressure there is no loss of energy by the transfer, the inter-connecting pipes being very short. The blower supplies air to the engine cylinders during the "induction" stroke at a pressure about the same as that at which the gases left the cylinders at the end of the expansion period adopted. The quantity of combustion air and fuel oil mixed in the cylinder being larger than in the normal type of engine, a higher power rating is gained, while the maximum pressure and temperature are not increased. The frictional and other losses (expressed as mean pressure) in a Diesel engine are almost a constant proportion of the indicated mean pressure, about 22 lb. per sq. in.; consequently the mechanical efficiency is improved. The efficiency of the process of combustion is the same as that of any ordinary Diesel engine, and the fuel consumption per unit of work is therefore also improved. The scantlings of the crankshaft in normal design are sufficient to support the slightly increased turning moment exerted. A series of independent tests carried out by Dr. Stodola, of Zurich, confirmed the claims made on behalf of Mr. Büchi's system. The non-supercharged engine at normal full load consumed 0.408 lb. of fuel oil per b.h.p. per hour with a mechanical efficiency of 72 per cent. When supercharged and giving the new normal full-load output, the fuel consumption amounted to 0.392 lb. per b.h.p. per hour, with a mechanical efficiency of 80.2 per cent.

(3) The "cold-starting" engine is singularly misnamed. In the opinion of the author (by no means accepted by all) this class of engine is a "Diesel" because the fundamental principle is satisfied by it. The fundamental difference between this class and the original is the nature of the heat cycle employed. The modern Diesel engine operates on a mixed-cycle wherein a slight rise in pressure occurs during the admission and ignition period of the process, such a cycle being thermally more efficient than the constant-pressure cycle; hence an indicator diagram exhibits a rounded top. The "cold-starting" engine, however, is practically, if not entirely, a constant volume machine. The indicator diagram presents a line nearly, if not quite, vertical from the end of the compression curve, and shows an explosive pressure rise up to a maximum of about 650-700 lb./sq. in. The economy of the engine is good; if anything, rather better than that of a Diesel engine of equivalent output, owing to the nature of the design and the absence of an air compressor. In England this engine is extensively manufactured by Messrs. Ruston, Hornsby & Co., Ltd., of Lincoln. At full load a fuel consumption of 0.396 lb. per b.h.p.-hr. is achieved, corresponding closely to a kWh consumption of 0.59 lb.

Drawing a line at about 600 b.h.p. capacity per engine, the "Diesel" engine in its modern form as an "air" or "airless" injection engine holds the whole heavy-oil-engine field above that limit. The tendency of design is markedly towards higher piston and rotational speeds, higher brake mean pressures and lighter construction to reduce first cost. A high-speed engine can be sold at a price about three-fifths of that of a low-speed engine of the same power.

Lay-out.—Engine foundations must be very carefully carried out. A modern heavy-oil engine is so beautifully balanced that earth tremors seldom cause annoyance. A maximum of 7 lb. of cooling water per kWh is an ample provision to make, and steps must be taken to reduce scale formation. Fuel-oil storage may be safely calculated on a basis of 3,500 kWh per ton of oil. The area of floor space required for low- and medium-speed heavy-oil engines is 0.60 sq. ft. per kW of capacity.

Results.—Perhaps the most valuable work accomplished by the Diesel Engine Users' Association is the annual analysis of heavy-oil-engine working costs. Though not representing total generating station results, their effect has been to create a species of ideal for the benefit of engineers and managers, fostering a healthy spirit of friendly rivalry. The returns, derived from a considerable number of members, are a source of authoritative information.

A general conclusion is that the airless injection engine is, in practice, about 2 per cent. more efficient and correspond-

ingly cheaper in fuel cost than an air injection engine of the same capacity. Official trials suggest a difference in efficiency between the air and airless injection types of about 8 per cent., corresponding closely to the power absorbed by the air compressor. The airless injection engine benefits also by the absence of the cooling effect of the blast air upon the combustion chamber contents at injection.

While it is unwise to draw a conclusion from the evidence afforded by a few stations, it would appear that the preference of the manufacturer and the user alike for running speeds not in excess of 250 r.p.m. has some justification. This remark is not extended to high-speed engines of 750 r.p.m. and upwards specially designed for land service; at present there is too little information available about them applicable to power station conditions.

In analysing heavy-oil-engine station costs the Diesel Engine Users' Association noticed an interesting fact in the position taken by a set of engines about 20 years old, which achieved the lowest average rate of fuel consumption per kWh in a list of 138 engines. That so low a fuel consumption as 0.665 lb. per kWh should be attained in the 20th year of an engine's life is a remarkable commentary upon the sustained efficiency of the heavy-oil engine. Except on account of obsolescence due to insufficient generating capacity, the question of depreciation from the point of view of economy hardly arises. The consumption noted is equivalent to a heat use of 12,967 B.th.u. per kWh. Another definite conclusion may be drawn: the cost of repairs and maintenance is low and shows little tendency to increase with age. One of the popular objections to the heavy-oil engine is its alleged costly repair bill, but actual experience during many years does not confirm this delusion.

Future Prospects.—Operating often under dreadful conditions of load factor, which precluded the hope of an economical use of steam power, and often equipped with a poor type of plant, undertakings did little but struggle under a burden of cost that strangled development. The Diesel engine came as a godsend to them. Thanks to its freedom from standby charges, to the small number of operators required, and to its inherent efficiency, companies began to pay dividends and municipal undertakings were able to reduce the price of energy and, in some cases, ceased to call upon the rates for assistance. The future of undertakings in this country of the "non-selected" type is very uncertain from the financial point of view. The heavy-oil engine has served them so well that their share in the good things to be offered by the Central Electricity Board may well be less than that of their colleagues who have clung to steam generation, perhaps not in its best form. Up to the present the bulk supply prices that have been arranged are not especially attractive when contrasted with local heavy-oil-engine generation, especially in an area where a power company is supreme. With increasing output the standing charges of the "oil" stations tend steadily to fall, so that the position of many of them, good as it may be to-day, contains the prospect of even better results were local generation to continue. Their future depends now upon the level of the bulk-supply charges, even if they remain active for peak-load work. These charges are an unknown quantity: those that have been provisionally agreed during the intermediate period of the construction of the primary and secondary transmission systems are not based upon any definite method of accountancy, and the ultimate charge may be something very different from the temporary charge, especially when it is remembered that the Central Electricity Board has power to suspend contributions to the sinking funds for five years. In general, rates of charge of the order of £3 per kilowatt and 0.25d. or 0.30d. per kilowatt-hour are too high to benefit a well established heavy-oil-engine generating station where extensions of similar plant can be effected. In units up to 1,000 kW capacity an extension can be carried out for an annual capital charge of about 30s. per kW (interest and repayment being calculated at 5 per cent. for the normal periods as a simple annuity). The heavy-oil engine is now regarded abroad not so much as a competitor of steam, but as an ally to be utilised in effective combination to secure the most favourable economic result.

There are numerous fields of application for the heavy-oil engine outside the power stations of statutory undertakers, notably in the private stations of industrial undertakings, and, of course, for all sorts of purposes in other countries where our export trade hopes to profit. Thanks to the somewhat illogical method of conducting the legislation of this country, the large privately-owned power-plant owner has been given unexpected and gratuitous aid in the form of rate reduction that is not extended to the statutory electricity supply undertaker. It is certain that the rate burden upon supply authorities will be increased in the immediate future and some revision of tariffs may be needed to meet the additional charges of the kind. There are instances in which the item "rates and taxes" will exceed in magnitude the fuel cost of undertakings. It cannot be surprising if some of the larger industrial concerns return to "self" generation and look favourably upon the simple, compact, highly efficient, and handy heavy-oil engine as an excellent means of satisfying their requirements. Should this possibility materialise it is not unlikely that the accelerated increase of output and demand upon which the 1926 schemes depend will fail to occur and the Central Electricity Board may be unable, whatever may be its intention, to sell energy at rates low enough to enable the local distributor to retain his best class of business.

Comparison of the capital and operating costs of 20,000-kW capacity generating stations equipped with heavy-oil engines and steam plant of good design, but not with the refinements incorporated in the largest base-load stations, with a maximum demand of 16,000 kW and annual demand load factors of 35, 25, and 20 per cent., shows the steam station to be the more economical to the extent of 4, 4.2 and 5 per cent., the maximum difference being of the order of £3,600 per annum. An increase of 10 per cent. in the price of coal (say 1s. 6d. per ton at 15s. per ton) would place the annual cost of the two equipments on level terms. Thus, the conclusion of engineers abroad that "there is nothing in it" between the two methods of generation when the output to be dealt with is considerable, is borne out. There may, however, be factors other than cost bearing an important influence upon the choice of plant. The oil-engine plant is simpler, requires a smaller staff, needs far less water, and oil storage is much less obnoxious to neighbours than a coal yard. The area of site will be less and it may be practicable to place the oil station nearer the centre of gravity of the supply system.

The use of the heavy-oil engine in the power station side by side with steam generating units, or in distant sub-stations for peak-load duty, has been much discussed, and in Germany combinations of the kind are frequent and are undoubtedly satisfactory. In making any such arrangement cost is not the only consideration to be taken into account; indeed, on a pure cost basis it is not always clear that a definite financial advantage can be obtained. The heavy-oil engine possesses a remarkable advantage over the turbo-generator in its capacity for quick starting from cold without any kind of preparation charge other than the standing charge for attendance and capital. The pulverised-fuel boiler has much improved the flexibility of the steam-raising section, but the turbine lacks flexibility entirely and careful adjustment of temperature is an essential before load can be applied. This consideration, among others, had weight in the decision of those responsible for the purchase of the 10,500-kW heavy-oil-engine set in Hamburg. Other towns in Germany, Bremen, Kottbus, and numerous others, have found this favourable feature of the heavy-oil engine a great convenience. At first sight the cost of a Diesel engine, round about £16 per kW with its foundations and generator, would not appear to be justified for short-hour use. The time factor may vary according to conditions from 200 to 1,000 hours and over; normally 800 hours is not unusual. Those who are accustomed to the non-industrial condition of a high peak load of short duration, combined with minor peaks that must be dealt with by overloading turbo-generators and steam-raising plant, are well aware of the heavy burden of cost imposed by standby and preparation costs. The liability to fog, or storm, and the impossibility of running a turbo-generator on to load very quickly, compel the simultaneous use of a greater number of generators than may be needed to meet the normal demand. The result is reduced efficiency in both the steam-raising and steam-using sections of the power station. While the rate of steam consumption varies but little in large turbines, the numerous sources of constant loss, in the aggregate and applied to large outputs, detract seriously from efficiency and constitute the equivalent of an additional standing charge when the generators are not operated at a high running plant load factor.

Comparison of the cost of 5,000-kW peak-load plant operated at a plant load factor of 85 per cent. shows the oil-engine equipment to be slightly cheaper in use than "good," and more expensive for the purpose than "high efficiency," steam plant. By "good" steam plant it is intended to imply an efficiency of the order of about 21-22,000 B.th.u. per kWh; by "high efficiency" 16,000-20,000 B.th.u. per kWh; that of the oil set is assumed to be about 12,000 B.th.u. per kWh. In the author's opinion the heavy-oil engine either for peak- or base-load duty at the main generating station cannot compete with the "high efficiency" base-load type of generating plant with its large overload capacity and quick steam-raising characteristics until the prevailing relative capital costs and fuel prices are materially altered. Nevertheless, a general conclusion cannot safely be made because of the great variety of local circumstances.

With regard to sub-station duty the position is governed entirely by the capital cost and the annual value of losses in transmission and converting plant, if employed. According to the capital cost of laying e.h.p. cables to a sub-station (and this item may be exceedingly heavy in a large city where the soil below streets and footways is generally congested with the mains of other public services) it may or may not be desirable to provide additional cables, either in the form of radial feeders, or as additions to a ring main system. There are, undoubtedly, cases in which the extension of sub-station plant by oil engines would effect an economical result, quite apart from the freedom from interruptions liable to be caused by cable or generating-station defects. The provision of quick-starting generating plant, entirely independent of the electrical system, on the "incoming" side in a heavily loaded district would add to the safety, continuity, and reliability of supply.

In a minor, but not unimportant, direction there is a strong case to be made out for the use of the heavy-oil engine as the primary source of energy for the internal auxiliary service of a steam generating station. In the interests of safety and in a dire emergency a completely separate system is a necessity when the auxiliary service is as important as that of a large generating station now is.

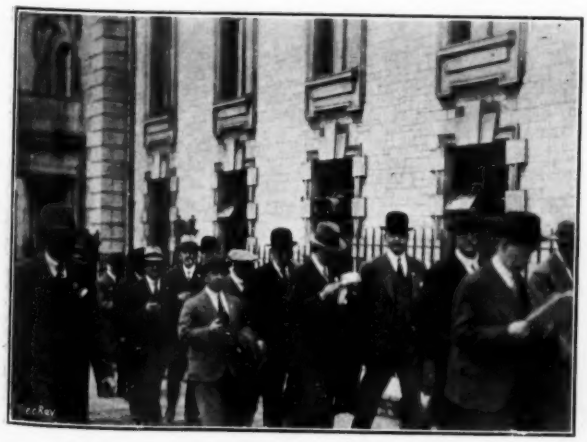
The I.M.E.A. at Torquay.

Members arriving to hear Mr. Jennings' Paper.

A Novel Craft in Torquay Harbour.

Mr. Frank Hodges and Sir John Brooke.

Mr. H. F. G. Woods.



Members arriving at Town Hall on Thursday.

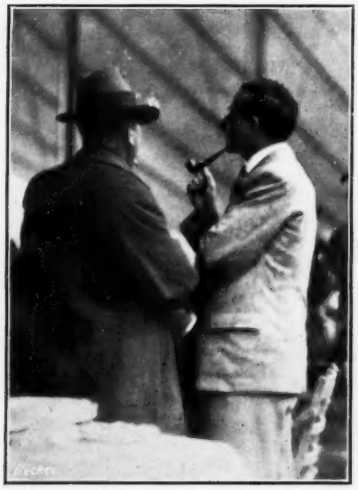
Entrance to Old Torbay Hospital.

The President, E.D.A., with Mrs. Nichols Moore.

Mr. T. R. Martin and Others.

Dr. Ferranti and Mr. and Mrs. Nichols Moore.

The Town Hall, Torquay.

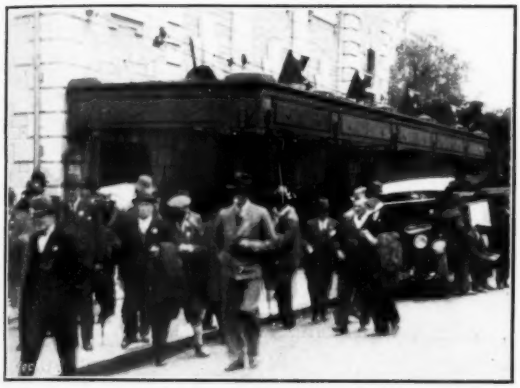


The Torquay Borough Electrical Engineer under Cover.

Messrs. G. J. and H. H. Berry Enjoying Life on board their "Lugger."

Miss M. Partridge, B.Sc.

Mrs. Ll. B. Atkinson and Mrs. Cramb.



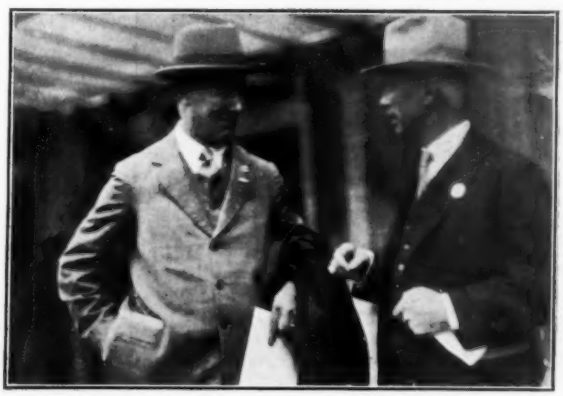
Members Leaving the Town Hall.

A Small Group Outside the Pavilion.

Ald. A. Smith and Mr. N. B. Coop.

Lt.-Col. Vignoles Greeting some Friends.

Dr. S. L. Pearce with Mr. H. C. Lamb.

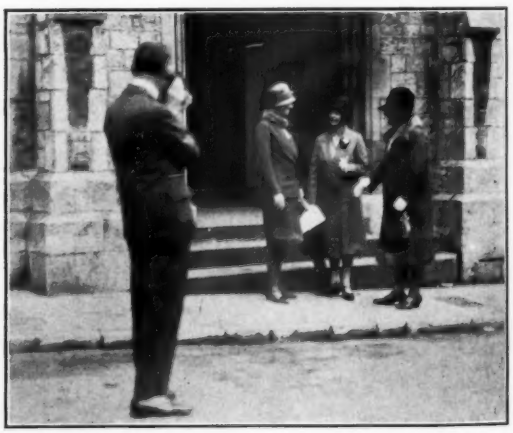


Mr. F. W. Purse with Mr. J. K. Brydges.

The Director, E.A.W., with two Members.

Members of the Council of the E.A.W.

The E.A.W. leaving for Devon Moors.



Lt.-Col. Vignoles Filming some of the Ladies.

Mrs. Nichols Moore.

E.A.W. Members Outside the Exhibition.

The I.M.E.A. Exhibition.

(*Continued from page* 1035.)

TUESDAY afternoon of last week saw much attention paid by members of the I.M.E.A. Convention to the exhibits in the Old Torbay Hospital, and the keen appreciation of the show as a whole by the members reflected the excellent work done by the Electrical Development Association in organising the exhibition, and by Mr. V. W. Dale, business manager, E.D.A., who was responsible for the lay-out and general arrangements. Various views of the stands, taken from different parts of the Exhibition, are shown on pages 1082 and 1083, and they depict the general pleasing character of the show as a whole. Throughout the Convention a goodly number of members of the public visited the Exhibition at appropriate times.

The developments of the GENERAL ELECTRIC CO., LTD., in the realm of both domestic and industrial appliances were well represented on the company's stand, and a selected range of modern lighting equipment was shown. The company concentrated upon those features as being of particular interest to station engineers. The new range of "Magnet" cookers, which embraces every type required for domestic purposes, from the "Magnet" minor breakfast cooker to the large table model cooker suitable for a family up to ten persons, was also included. The breakfast cooker has the special features of separate boiling plate, grill, and oven elements, independently controlled by 3-heat reciprocating switches. The "Magnet" automatic cut-out safety kettle, a range of "Magnet" fires in special finishes, and a new type of wash boiler were among the other items displayed. Of industrial appliances, there was a special display of garage equipment, the possibilities of which have been drawn attention to recently by the British Electrical Development Association. An effective demonstration of water heating was given in one of the rooms, a section of which was subdivided into a kitchen and bathroom, the entire water supply for which was furnished from a "Magnet" water heater in the kitchen. The selection of lighting fittings on show included "Perlique" glassware, demi-coupe glassware, wall brackets, enclosed units and industrial reflectors, including the "Wembley" lantern.

Fig. 6.—New "Magnet" Storage Water Heater.

Special features of the G.E.C. display were a new storage water heater and a new wash boiler. The "Magnet" water heater, fig. 6, incorporates, it is claimed, all the features which long experience has shown to be necessary for high thermal efficiency, combined with robust construction. It is made in sizes from two gallons upwards, and arranged for floor or shelf mounting. Of pleasing appearance, with white-enamel finish, it is of sound mechanical design and capable of simple adjustment within suitable limits of temperature. It is double-cased, and has three inches of efficient lagging between the outer case and inner container. The inner container is of steel or copper, and is tested to withstand a pressure of 25 lb. per sq. in. The heater, which is suitable for all voltages from 200 upwards, is equipped with a thermostat of the quick-make and -break bi-metal type, and can carry up to 5 A a.c. For d.c. and for more than 5 A a.c. a relay switch must be added. The standard "Magnet" withdrawable-type immersion heater is fitted. The wash boiler operates on the thermo-siphon principle, with an internal percolator giving very free circulation, heat loss being reduced to a minimum by ample air spacing between the inner container and the outer casing. This outer casing, which is mounted on three legs, is of galvanised-iron, and the container is of heavily-tinned copper. The boiler is fitted with a heavy-gauge galvanised-iron lid, and when reversed this lid serves the purpose of a table. The elements are of the strip type, each enclosed in a protecting copper sheath clamped to the bottom of the container. Control is effected by means of a 20-A, 3-heat, reciprocating-type, rotary switch mounted in a cast-metal box with an enamelled cover, which is connected to the wash boiler by a 4-ft. length of 4-core c.t.s. cable. Both control box and boiler are fitted with earthing terminals.

The main exhibit on the stand of the HOTPOINT ELECTRIC APPLIANCE CO., LTD., comprised a range of new model "Hotpoint-Falco" electric cookers. The main characteristics of the "Hotpoint-Falco" designs are retained. The prevention of moisture passing from the boiling section to the oven section is attained by the provision of a cast-iron crown plate with a protecting rim. This also provides a non-corroding division plate that will not be readily destroyed under the adverse conditions in which some cookers operate. The oven element assembly is in one unit and can be removed from the

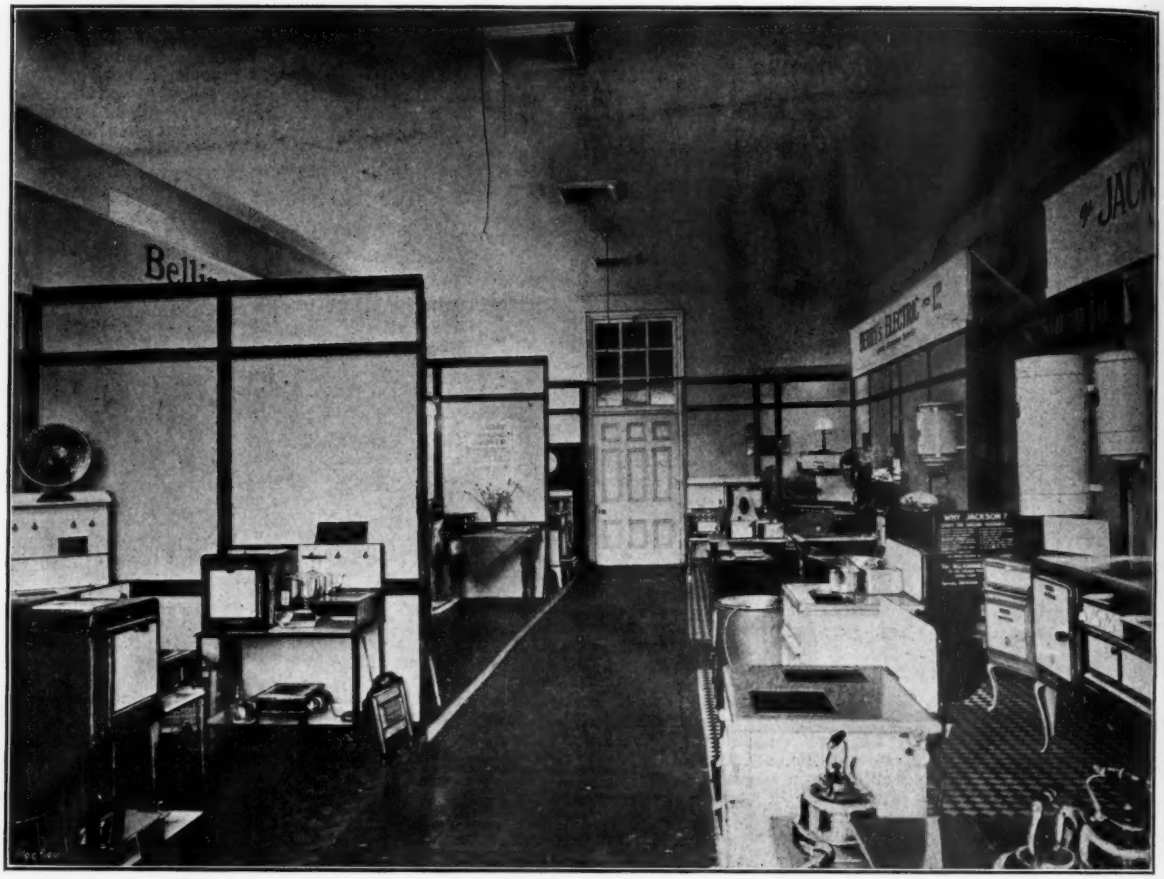
Fig. 7.—The "Manorette" Cooker.

oven by undoing two wing nuts and three terminal wires. Similarly, the whole switch assembly is made in one complete unit, and can be readily removed, after detaching the right-hand portion of the hob, by the removal of only three screws and disconnecting the leads from the boiling plates, grill and oven. The wiring of the cookers is simple. Where a relatively long run of conductor is necessary, as under the hob to the boiling plate or plates on the extreme left, the wiring is carried in a channel of cast-iron, vitreous enamelled. This coating of enamel is made to stand a pressure of 1,500 V to "earth." One of the cookers shown is of the latest popular finish, *i.e.*, mottled-grey enamelled. In addition to the cooking apparatus by this company, there were on show the "Hotpoint-Maytag" electric washing machine, the tub of which is constructed of cast-aluminium and operates on the "gyrafoam" principle; the "Premier-Junior" and "Premier-Duplex" electric vacuum cleaners; and a general display of "Hotpoint" electrical appliances.

Among an interesting display of cookers on show on the stand of the MANOR ELECTRIC OVEN & FIRE CO. was the "Manorette" cooker, fig. 7. The outside dimensions of the cooker are height 19 in., width 28 in., and depth 15 in. The door and front frame are constructed of fine cast-iron, and the body, base-plate and back of mild-steel. The interior

Fig. 8.—The "Jackson" Junior, with Legs.

of the oven is of blue planished steel. All the steel parts are treated with rust preventive compound, stoved on, and the exterior is finished in stoved black-enamel. The interior dimensions of the oven are 12 in. by 12 in. by 11 in., the loading being 200 W. The boiling plate and grill is of the standard "plug-in" type, with a loading of 1,800 W. The hob and crown plate are vitreously enamelled. The oven and boiling-plate elements are 3-heat controlled. A six-bar radiator displayed by this company has a total loading of 3,600 W, the overall dimensions being 20 in. high by 15 in. wide. It can be supplied in stoved black-enamel or electro-bronze finishes. Other "Manor" exhibits included a 10-gal. wash boiler with



Examples of the Varied Character of—

Views of the Exhibits at the Old Torbay Hospital, taken from different parts—

—the Domestic Electrical Apparatus Displayed.

—of the Exhibition, depicting the general pleasing character of the Show.

overall dimensions of 32 in. high and 20 in. in diameter, and with a loading of 4,000 W; bowl fires; a table heater measuring 3¼ in. high by 18 in. wide by 10¼ in. deep, having a loading of 200 W; and a special wash boiler and a bath heater as supplied to the Willesden Council. The "Manor" heating elements are protected from damage by "Steatite" tubes.

The JACKSON ELECTRIC STOVE CO., LTD., had on show a range of cooking cabinets in marblon all-enamelled finish, and the "Jackson Junior" cooker, fig. 8, which, it is claimed, is being supplied in thousands to supply authorities for hire and hire-purchase purposes. The Jackson exhibits also included a No. 51 cooker, which is similar to the No. 50 J. model, but has a self-contained boiling plate in addition to a grill-boiler, the latter being slightly smaller than that on the No. 50 J. hob; the oven is the same. Another item on this stand was the No. 48 new table cabinet on the lines of the No. 46 model. Messrs. Jackson also showed a range of fires finished in the new Chinese styles. It is believed that it was the first time these particular finishes have been applied to electric fires. The effect is to dispel the somewhat metallic appearance given by the average electric fire when supplied in brass or copper. A new Jackson wash boiler shown, No. 155, is similar to the No. 154 model, but the bottom of the former has a smooth surface.

In addition to the new design of Berry-McClary cooker, and new models of "Magicoal" electric fires, BERRY'S ELECTRIC (1928), LTD., exhibited a domestic water heater, introducing some new features. It is of the storage-tank type, with low consumption. The interior is built up from a unit system, enabling the heating element and thermostat to be withdrawn without emptying the water from the con-

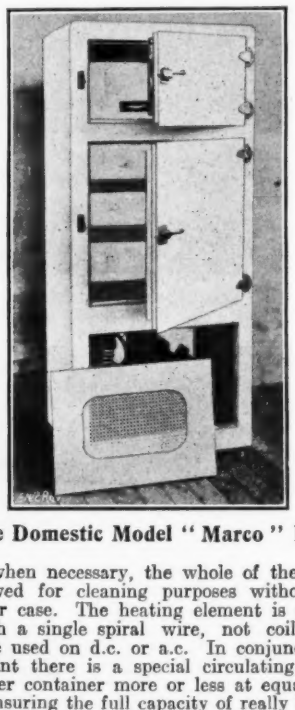


Fig. 9.—The Domestic Model "Marco" Refrigerator.

tainer, and, when necessary, the whole of the internal gear can be removed for cleaning purposes without interfering with the outer case. The heating element is of robust construction, with a single spiral wire, not coiled. The thermostat can be used on d.c. or a.c. In conjunction with the heating element there is a special circulating device which keeps the inner container more or less at equal temperature throughout, ensuring the full capacity of really hot water. It is claimed that the trouble of constant dripping on the hot-water side has been definitely overcome in this cooker.

Among the range of refrigerators displayed by MARCO REFRIGERATORS, LTD., were the small domestic model MC.159, fig. 9, which has an internal capacity of 8 cu. ft., in white-enamel finish; domestic models MC.127-130, with internal capacities varying from 10 to 28 cu. ft.; and commercial models with capacities up to 58 cb. ft. There was also on show on this stand a new standard model, No. 35, which is claimed to be particularly suitable for butchers, provision merchants, &c. This model has an internal capacity of 35 cu. ft., and is fitted, in addition to ceiling hanging rails, with a tier of instantly-removable slatted wooden shelves.

The exhibits by Messrs. MOORWOODS, LTD., included the large, medium, and small models, in addition to the "Moorwood-Junior" cookerette and a selection of electric fires, including a stainless-steel fire and a mantel register suite. The "Moorwood" electric cooker is specially designed to meet the requirements of the average household. The oven is made in one piece, with all corners rounded, and is easily removable for cleaning. The oven elements are placed at each side and one at the bottom; the elements are spread over a wide area, are interchangeable, and are all 3-heat controlled. The oven is provided with a grid shelf, slide shelf, and pudding tin, and is enamelled throughout. Two 8-in. diameter fast boiling plates are fitted to the No. 210 cooker, and one to each of the smaller models. In addition, an efficient covered grill and boiling plate is provided on each model, controlled by an individual three-heat switch.

(To be continued.)

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

The Economic Effects of Monopoly on British Power Stations.

Many of your readers will be disappointed at your brief, but decidedly biased, review of this important book by Mr. A. H. Swain. It is all very well to say that the facts which form the background of the book had better be forgotten. Why should they? Is it of no importance to the public and ratepayers what prices are charged by manufacturers, seeing that the price of electricity is bound up with the cost of heavy machinery and cable?

Your remark that "If manufacturers will *assure themselves* that the prices which they quote are reasonable . . ." is really too humorous. It is quite simple and only natural for manufacturers to assure themselves. What is of greater importance is to assure the public, or the local authorities who represent the ratepayers and consumers, and this is the whole point. Mere rhetoric will not convince them when they are quite aware of the profits, for example, of the members of the C.M.A., their reserves, and the prices of their shares as quoted on the Stock Exchange.

Consider the vital question of rural electrification: a cheap supply of electricity to the rural areas is a matter of life or death to the already desperate agricultural industry. Those who have read your report of Col. Vignoles's paper in last week's issue may have been struck by the remarks of Mr. Turnbull, of Aylesbury, as follows:—

> "He was getting [from the Government] 2½ per cent. of his interest paid, but that was on condition he used unemployed miners and also *British cable*. The latter meant an increase of 50 *per cent.* over the price paid for foreign cable, and therefore it became questionable whether there was any advantage in having Government assistance in the matter."

These remarks need no comment other than that one would think they lend excellent support to Mr. Swain's contentions.

There are chief engineers who find it much more convenient to take the path of least resistance and pay the price demanded. On the other hand, there are others who realise their responsibilities as good citizens and are jealous of the reputation and efficiency of their undertakings. It is bad enough to be at the mercy of rings at home, but seeing that leading members of the B.E.A.M.A. are gradually coming under the influence of cartels dominated from New York, the matter cannot be contemptuously dismissed as of no consequence.

Mr. Swain deserves the gratitude, not only of engineers, but also of the general community, for bringing this serious subject to their notice.

"Blessed are those who eschew the path of least resistance, for they are the salt of the earth."

Citizen.

June 6th, 1929.

X-rays at Sea.

We are very interested to see in your issue of to-day's date, amongst your "Notes," a description of X-ray apparatus for use on board ship. We feel, however, that in justice to ourselves and other British makers of X-ray apparatus, we must correct the impression which is given that hitherto X-ray work afloat has not been possible.

We ourselves have made and supplied many sets to be used in such circumstances, and it is within our knowledge that other firms in the electro-medical industry have done so also.

X-ray apparatus is a standard part of the equipment in the British Navy, and although the type of installation used may not be of the most modern character, this fact is well known to everybody concerned, and a certain policy has been adhered to for special service reasons.

X-Rays, Limited,
CUTHBERT ANDREWS.

London, *June 7th*, 1929.

Tramcar Regenerative Braking.

In your issue of March 22nd, 1929, you publish a letter from Mr. E. H. Croft in which he refers under the above heading to an article of mine in the ASEA *Journal*, Vol. 5, 1928. Mr. Croft criticised my suggestion for obtaining good braking by connecting a small resistance in series with each motor armature, but as his remarks are based upon a misunderstanding I should like to explain matters a little further.

The small resistances referred to are only in circuit during braking. It is to be regretted that the diagram accompanying my article is small and difficult to follow, but the principle of connection for motoring and braking appears moderately clearly from the figures on the right hand side of the diagram. With the controllers shown, no alteration is necessary if the small

equalising resistances are added. As expounded by Mr. Croft, I do note think that the method would make a more endearing appeal to a foreign than to a British engineer.

Mr. Croft further states that I have missed a point in failing to state that the breaking of one lead prevents braking on both motors with the well-known cross-field connection. Here he has certainly not studied my article very carefully, as I distinctly mention at the conclusion that my suggested arrangement has the advantage over a cross-brake connection that, should a breakdown occur on one motor, the other will still continue to act as a brake.

I may mention that there is a method of making the cross-brake connection function properly when the brake circuit is interrupted by connecting a resistance across the cross connection. I refer here to the American patent No. 1076298 of Mahoney, and the German patent No. 309554 of Krauss.

My article was, I may say, first written in 1921 and was solely intended to convey to interested parties information regarding a method of connection which would enable very good braking to be obtained without involving any alteration to the controllers.

I certainly intended no criticism of the article written by Mr. Croft, and I consequently consider his remarks rather unjustified.

P. Friebel.

June 10th, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1927.

28,905. "Means for controlling the intensity of a beam of light for use, for example, in recording sound." A. Whitaker and Gramophone Co., Ltd. July 4th, 1928. (311,520.)

31,489. "Electromagnetic transmitters and receivers for reproducing sound." A. F. Sykes. November 23rd, 1927. (Patent of addition not granted.) (311,826.)

33,689. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. January 13th, 1927. (283,543.)

1928.

965. "Automatic telephone systems." Siemens Bros. & Co., Ltd., C. L. Peters, and D. A. Christian. January 11th, 1928. (311,666.)

1,344. "Sound-reproducing apparatus." C. M. R. Balbi. January 23rd, 1929. (311,835.)

1,543. "Means for the protection of electrical installations." W. Fennell. January 17th, 1928. (311,792.)

1,573. "Electric switchgear." British Thomson-Houston Co., Ltd., M. C. L. Hunter, and W. P. Hamlyn. January 17th, 1928. (311,793.)

1,574. "Draw-out electric switchgear." British Thomson-Houston Co., Ltd., M. C. L. Hunter, and W. P. Hamlyn. January 17th, 1928. (311,794.)

4,377. "Railway signalling apparatus of the double-wire transmission type." A. G. Kershaw and Westinghouse Brake & Saxby Signal Co., Ltd. February 11th, 1928. (311,676.)

4,391. "Composite magnetic materials." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). February 11th, 1928. (311,677.)

4,640. "Measuring and like apparatus for use with high-potential circuits." International General Electric Co., Inc., and C. G. Mayo. February 14th, 1928. (Addition to 224,673.) (311,796.)

4,641. "Vapour-electric rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. February 14th, 1928. (311,681.)

4,650. "Electric heating units." S. Morse. February 14th, 1928. (311,682.)

4,677. "Printing wheels suitable for use in telegraphic receiving and printing apparatus." Creed & Co., Ltd., and F. G. Creed. February 14th, 1928. (311,684.)

4,694. "Electric communication cable." Standard Telephones & Cables, Ltd., and W. K. Weston. February 14th, 1928. (311,685.)

4,695. "Automatic switches for telephone systems." Standard Telephones and Cables, Ltd., and M. S. Snell. February 14th, 1928. (311,686.)

4,787. "Electromagnetic instruments for converting oscillating currents into sound and *vice versa*." British Thomson-Houston Co., Ltd., and L. B. Ault. February 15th, 1928. (311,722.)

4,934. "Vapour-electric rectifiers." British Thomson-Houston Co., Ltd., and J. C. Read. February 16th, 1928. (311,801.)

5,013. "Control of output of variable-speed electric dynamos." F. H. Royce. February 17th, 1928. (311,806.)

5,054. "Interlocking electromagnetic relays." Automatic Telephone Manufacturing Co., Ltd., and C. H. Brizell. February 17th, 1928. (311,807.)

5,067. "Picture-transmission system." W. E. Beatty (Bell Telephone Laboratories, Inc.). February 17th, 1928. (311,810.)

5,893. "Device for producing electric discharges of predetermined duration and constant intensity." L. N. Brillouin. March 8th, 1927. (286,666.)

5,946. "Remote-control arrangements for electric alternating-current distribution systems." C. Lorenz Akt. Ges. March 18th, 1927. (287,161.)

6,004. "High-tension electrical supply for wireless apparatus." H. R. Milnes. February 27th, 1928. (311,849.)

6,264. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. February 28th, 1928. (311,851.)

6,389. "Electric motors." E. D. Feldman. February 29th, 1928. (311,853.)

6,643. "Luminous circuit charts." Siemens & Halske Akt. Ges. July 22nd, 1927. (Addition to 283,893.) (294,227.)

8,400. "Apparatus for locating the direction of sound and sound-signals." D. W. Smith and H. W. Whyte (executor of R. J. W. Whyte (deceased)). March 20th, 1928. (311,869.)

8,592. "Electromagnetic actuating mechanism for the reproduction of sound with radio loud-speakers, telephone receivers, and the like." R. I. Denham. March 21st, 1928. (311,870.)

8,712. "Mechanical trip devices applicable for use with electric switches and for other purposes." English Electric Co., Ltd., and H. Bacon. March 22nd, 1928. (311,871.)

9,464. "Electrical relays and amplifiers." P. Freedman and W. J. Rickets. March 29th, 1928. (311,881.)

9,499. "Electrically-driven floor brushes." A. Giambertoni. March 29th, 1927. (287,914.)

9,561. "Means for the protection of electrical installations." W. Fennell. January 17th, 1928. (Divided application on 311,792.) (311,811.)

10,022. "Means employed for supplying current or potentials from mains to utilisation means." Graham Amplion, Ltd., and P. K. Turner. April 3rd, 1928. (311,893.)

10,113. "Electrical switches and switch fuses." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. April 4th, 1928. (311,895.)

11,140. "Incandescent electric lamp fittings." R. I. Scorer. April 16th, 1928. (311,906.)

11,967. "Electric cables." Siemens Bros. & Co., Ltd. (C. W. Schofield). April 24th, 1928. (311,914.)

11,982. "Electric switch lampholders and the like." R. Nettl. April 24th, 1928. (311,915.)

12,196. "Means for measuring the rate of generation of electrical impulses." Coventry Automatic Telephones, Ltd., and J. E. Collyer. April 26th, 1928. (311,921.)

13,300. "Measuring or indicating instruments." R. Amberton and Electrical Apparatus Co., Ltd. May 5th, 1928. (Cognate application, 3,804/29.) (311,929.)

14,179. "Timing adjustment of magnetos for internal-combustion engines." G. Cattaneo. May 13th, 1927. (290,584.)

14,759. "Multi-part insulators." D. H. Rowland. May 24th, 1927. (291,028.)

16,283. "Apparatus for the inter-conversion of mechanical and electric oscillations." British Thomson-Houston Co., Ltd. June 6th, 1927. (291,734.)

17,109. "Lamps for power-driven vehicles." R. Hansen. June 13th, 1928. (311,959.)

17,394. "Miners' electric safety lamps." J. H. Pease. June 15th, 1928. (311,963.)

20,084. "Gaseous-conduction electrical rectifiers for alternating current." Westinghouse Lamp Co. July 20th, 1927. (294,208.)

20,327. "Trucks or wheeled underframes for tramway, railway, and like vehicles." Electro-Mechanical Brake Co., Ltd., and J. H. Williamson. July 12th, 1928. (311,981.)

21,597. "Remote-control systems." Associated Telephone & Telegraph Co. September 3rd, 1927. (296,664.)

21,605. "Electrically-heated massage appliances." M. Kramer. July 25th, 1928. (311,992.)

23,360. "Circuit arrangements for operating an electric discharge tube with direct current." Naamloose Vennootschap Philips' Gloeilampenfabrieken. September 2nd, 1927. (296,432.)

24,269. "Electric resistance furnaces." Hevi Duty Electric Co. May 22nd, 1928. (312,006.)

29,263. "Mercury-vapour rectifiers." Associated Electrical Industries, Ltd. October 11th, 1927. (298,572.)

30,541. "Double-cap insulators." Akt. Ges. Brown, Boveri et Cie. October 21st, 1927. (299,322.)

35,655. "Electric selective arrangements for operating alarm devices." Soc. Française Radio-Electrique. December 2nd, 1927. (301,753.)

36,557. "Electric transmission of pictures." C. Lorenz Akt. Ges. December 23rd, 1927. (302,901.)

1929.

1,791. "Arrangements for eliminating disturbing and secondary waves in wireless circuits." C. Lorenz Akt. Ges. January 31st, 1928. (Addition to 263,825.) (305,131.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from June 5th:—

Pathfinder (lettering and design). No. 498,136. Class 8. Radio-telephonic apparatus.—Essex Radio Supplies, Ltd., 35, Norton Folgate, E.1.

Movector. No. 500,080. All goods in Class 8.—The I.G. Farbenindustrie Gesellschaft, 28, Mainzerlandstrasse, Frankfort-am-Main. (British representatives: Abel & Imray, 30, Southampton Buildings, Chancery Lane, W.C.2.)

Three Torches (lettering and design). No. 501,981. Class 8. Electric batteries (not for medical purposes).—H. S. Myers, 6, St. Andrew's Buildings, Gallowgate, Newcastle-on-Tyne.

Solink. No. 500,322. Class 13. Electric lighting fittings, junction boxes, fusible cut-outs, switches, and circuit-breakers.—Donovan & Co., Northcote Road, Stechford, Birmingham.

Utilising the Thermal Heat of the Sea.

At a recent meeting of the French Academie des Sciences, M. Georges Claude gave some details of the latest developments in connection with the Claude-Boucherot method of utilising the thermal heat of the sea. In order to demonstrate the system, an experimental plant (ELECTRICAL REVIEW, January 11th, 1929, p. 58) was last year established on the River Meuse at Ougrée, Belgium, with the object of ascertaining whether the system could be successfully applied in connection with agitated sea water. M. Claude recently visited Cuba, and as a result of his cordial welcome it has been decided to transfer the experimental plant from Belgium to Cuba, where it is possible to draw water from a considerable depth. To this end he is having constructed a suction pipe about 6½ ft. in diameter and a mile and a quarter in length, which will allow the necessary water to be obtained from a depth of 1,968 feet and at a point nearly a mile from the coast. The pipe, except at the land end, will be only 2 mm. thick, but in order to obtain strength and to allow it to adapt itself to any sea-bottom irregularities it will be corrugated. To find a suitable locality for the plant, M. Claude engaged a steam yacht equipped with special depth-sounding equipment, and eventually decided on a place known as Matanza, about 60 miles east of Havana. The work is well in hand, and M. Claude is looking forward to making experiments under conditions that will be practically identical with an industrial installation.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BARNES (SURREY).—Girls' secondary schools, East Sheen, for Surrey E.C. (£35,200); W. W. Finny, secretary, Kingston-on-Thames.

BICESTER.—Re-erection of Cottisford House (mansion), residence of J. Bertram.

BILLINGHAM (STOCKTON-ON-TEES).—Hotel, for J. Eadie and Co. Houses (34), Sunnybrow estate, for Harland and Parker.

BIRKENHEAD.—Housing scheme (182), for T.C.; R. W. Johnston, borough engineer (returnable deposit of £2 2s.).

BIRMINGHAM.—Nine schools on housing estates; Education Committee. School, Pipes Hayes (£18,000); Education Committee. Elementary school, Upper Witton (£20,000); four infant welfare centres (£22,000); nurses' home and extensions, Little Bromwich hospital (£72,866); tuberculosis centre and laboratory, Margaret Street (£45,000); isolation hospital, Little Bromwich (£57,000); city engineer. 570 houses on Corporation estates; Henry Boot & Sons, Ltd., and Jones & Spencer, Ltd. Cinema, Grove Lane and Dudley Road, for A. Furze.

BLACKBURN.—Secondary school for girls, Troy estate; director of education.

BRADFORD.—Warehouse, Thornton Road; city engineer.

BRENTFORD.—Hospital extensions (£100,000); Board of Guardians.

BRIGHTON.—Extensions, Brighton College (£12,000); Messrs. Longley, builders, Crawley.

CAMBUSLANG.—Cinema; N. B. Theatres (Cambuslang), Ltd., 163, Hope Street, Glasgow. Cinema, Main Street, for Savoy (Cambuslang), Ltd.

CANTERBURY.—Electric lighting installation, for the Board of Guardians; clerk.

CARLISLE.—Re-erection of premises, Caldewgate, for the Carlisle Bread & Flour Co. (£10,000).

CHADWELL HEATH.—Factory, High Road; J. T. Luton and Sons, Ltd.

CHELTENHAM.—Pump house, Tewkesbury Road; Shell-Mex, Ltd.

CHISLEHURST.—Cinema, Albany Road and Red Hill, for W. Fletcher, 20, Albany Road.

COVENTRY.—Works, Stoke Heath, for the National Cork Industries, Ltd.

COWES (ISLE OF WIGHT).—School centre; Education Committee.

DONCASTER.—Girls' school and extensions, for the borough E.C.; J. B. Richardson, architect, 26, Printing Office Street (returnable deposit of £2 2s.).

DORKING.—Secondary school (£51,520), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

ELLESMERE PORT AND WHITBY.—Municipal buildings and market hall, for the U.D.C.; E. E. Evans, architect, 17, Beresford Road, Oxton, Birkenhead.

FARNHAM.—Girls' secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

FRESHWATER (ISLE OF WIGHT).—Re-erection of Palace Cinema; W. G. Barnard.

FRIMLEY.—Secondary school (£33,382), for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

GLASGOW.—Cinema, Possil Road; J. McAllister, 59, Bath Street. Cinema, Amulree Street; G. Singleton, Cambuslang. Workshop and stores, for Corporation Housing Department; the director.

GLOUCESTER.—Hostel, Training College for Domestic Science (£39,000), for Gloucestershire E.C.; director of education, Gloucester.

GRAYS.—School (£28,000), for Essex E.C.; J. Stuart, county architect, Chelmsford.

HANWELL.—Secondary school, Drayton Bridge Road (£40,000); W. S. Try, Uxbridge.

HAREFIELD. — Nursing accommodation at sanatorium (£34,000); Middlesex county architect.

HOVE.—Ice rink (£67,500); Ice Rinks, Ltd.

HULL.—Installation of electric lighting at the central public library; rehousing scheme (£94,200); elementary school, Westcot Street; D. Harvey, city architect, Guildhall.

IRISH FREE STATE (DUBLIN).—434 houses in the Donnycarney area, for City Commissioners; city architect, Exchange Buildings, Lord Edward Street.

(RUSH, CO. DUBLIN).—National school, Loughshinney (deposit £1); R. Donnelly, architect, 14, Lower O'Connell Street, Dublin.

(DALKEY, CO. DUBLIN).—Installation of electric lighting in town hall and offices, for U.D.C.; J. G. Treston, town clerk.

LANCASTER.—43 houses, Corporation estate; F. Moore and Co., Morecambe.

LEEDS.—180 houses, Middleton estate; F. Clough. Extension, 'bus garage; city engineer.

LEICESTER.—Housewifery centre, Knighton Fields House; Education Committee. Four shops, Braunstone estate (£10,000); Leicester Co-operative Society, Ltd.

LEWES.—Boys' secondary school, for East Sussex E.C.; Ringmer Building Works, contractors.

LONDON (ILFORD, E.).—159 houses, Tavistock Gardens, &c.; J. Aldridge.

(LEYTON, E.).—Wash-houses, for T.C. (£14,500); borough surveyor.

MANCHESTER.—Improvement scheme, Mosley Street and Marble Street (£83,600); city engineer. Electricity supply, Cooke Street Centre, Hulme; Education Committee. Extensions, College of Technology (£320,000), for the E.C.; Director of Education.

MILL HILL.—Secondary school; Middlesex Education Committee.

MITCHAM.—Houses (300) and shops, for the U.D.C.; A. A. Moyniham, builder.

MUSSELBURGH.—100 houses, for Corporation; burgh surveyor.

NEWARK.—County Technical College and School of Art, on the Chauntry site, for Notts. E.C. (£24,630).

NORTHALLERTON.—County hall extensions (£9,027), for North Riding C.C.; Armitage & Hodgson, Ltd., builders, Camp Road, Leeds.

NORTHAMPTON.—46 houses and 1 shop, St. David's estate; A. Glenn & Sons, Ltd.

OXFORD.—400 houses at Cowley, 600 at Headington, and 250 at Summerton; Allied Building Corporation. Development of Temple Cowley estate; F. & R. Lewis, Ltd.

PLYMOUTH.—Development, Beaumont Street estate; St. Aubyn Estates, Ltd.

REIGATE.—Refuse destructor and plant (£10,678), and additional 28 houses, for the T.C.; borough surveyor.

RIPON.—Aerodrome, Pateley Bridge Road; Corporation Industrial Committee.

SHEFFIELD.—62 houses, Greystones Grange; W. Malthouse, Ltd. Extension of Lodge Moor Hospital (deposit £2); W. G. Davies, city architect, Town Hall.

SITTINGBOURNE.—Housing scheme (60), for the U.D.C.; W. Lashmar, surveyor (returnable deposit of £2).

SOUTHBOROUGH.—Cinema, High Brooms; High Brooms Brick & Tile Co., Ltd.

SOUTHEND-ON-SEA.—Re-erection of Hamstel Works, Southchurch, electrically equipped; O. Kennedy, 65, Ilfracombe Road.

STRETFORD.—58 houses, Ryebank and other roads; W. R. Rochell.

THORNE (YORKS.).—Housing scheme (64), for the R.D.C.; H. Plewes, surveyor. Schools, for West Riding E.C.; education architect, County Hall, Wakefield.

WALSALL.—50 houses, Bleckenall estate, Bloxwich; A. Smith.

WEYBRIDGE.—Ballroom, &c. (£25,000), Oatlands Park Hotel; proprietor.